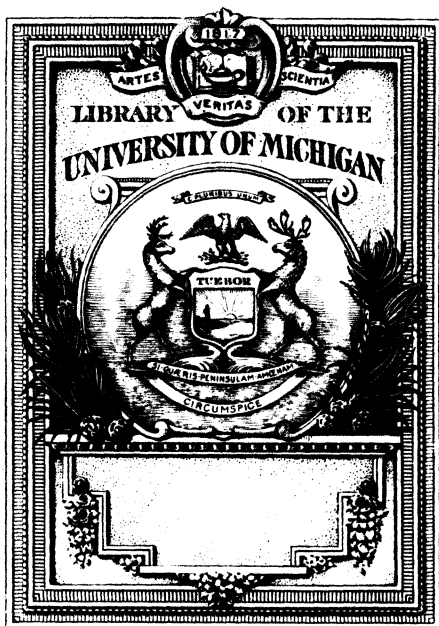


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FOURTH ANNUAL REPORT

OF THE

PHILIPPINE COMMISSION.

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1903.

IN THREE PARTS.

Part 2.

BUREAU OF INSULAR AFFAIRS, WAR DEPARTMENT.

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FOURTH ANNUAL REPORT

OF THE

PHILIPPINE COMMISSION.

REPORT OF THE SECRETARY OF THE INTERIOR.

DEPARTMENT OF THE INTERIOR,
Manila, P. I., November 24, 1903.

GENTLEMEN: I have the honor to present my second annual report, which, unless otherwise expressly stated, covers the year ending August 31, 1903. It has been prepared under difficulties, for the reason that, having been absent on leave since June 27, I have only such knowledge of events subsequent to that date as I can derive from the reports of chiefs of bureaus, which were received so late that it has been necessary for me to complete my own report during the early part of my return voyage.

ORGANIZATION OF THE DEPARTMENT.

The organization of the department of the interior has been but slightly changed during the past year. No new bureau has been created, although changes have been made in the personnel of many of the existing bureaus, as increase in work has necessitated increase in their working force.

By act No. 744, passed April 8, 1903, the bureau of patents, copyrights, and trade-marks was placed under the immediate direction of the chief of the bureau of archives, and thus brought under the executive control of the secretary of public instruction.

THE BOARD OF HEALTH FOR THE PHILIPPINE ISLANDS AND THE CITY OF MANILA.

The board of health has done admirable work during the past year. There has been no change in its personnel. Maj. E. C. Carter, the commissioner of public health, has shown himself to be a very efficient organizer and administrator. He has brought the office force of the board to a degree of efficiency not heretofore attained; has met the opposition of an association of property holders which has attempted to prevent the enforcing of sanitary regulations with unfailing courtesy and unflinching firmness, and has overcome the difficulties arising from the attitude of the municipal board of Manila toward sanitary measures

deemed necessary by the board of health for properly safeguarding the health of the city with a patience and perseverance which have challenged admiration.

All that has been done has been accomplished in the face of a practically unanimous opposition on the part of the native population of the city, most of whom appreciate neither the theoretical value of sanitary reforms nor the importance of the practical results which have been obtained. The steady improvement in the health of Manila, brought about in spite of these adverse conditions, bears eloquent testimony to the energy, industry, and ability of the members of the board of health.

RINDERPEST.

Through the cooperation of the bureau of government laboratories and the board of health, the entire situation with respect to rinderpest has been changed. A halt has been called upon the march which this disease was making through the archipelago, and the restocking of the islands with immunized horned cattle has been made possible, so that the prostration of agriculture due to lack of carabaos with which to plow the soil can now be relieved.

HEALTH WORK IN MANILA.

During the eight months of the present year only one-tenth as many cases of cholera have occurred in Manila as in the nine previous months during which the disease has existed. On the worst day of the entire epidemic of 1902-3 there were but one-thirteenth of the number of cases which developed during a similar period in the last epidemic which occurred under the Spanish administration.

Smallpox has ceased to be an important factor in the death rate of Manila, fifteen times as many persons having been vaccinated during the past twelve months as were vaccinated by the Spaniards during the five years previous to American occupation. The city has been brought into a sanitary condition never approached under the previous administration, and its death rate so reduced as to compare favorably not only with that of other tropical cities, but even with that of many cities in the United States. It is hoped that eventually these results will begin to appeal to the popular mind. Meanwhile, the board can only continue to do its duty in the face of whatever opposition may arise.

The magnitude of the operations of the board is shown by the fact that its expenditures for the year have aggregated \$1,082,255.41, local currency, and ₱131,890.56, Philippine currency.

Sanitary inspection has been maintained in Manila under the direction of the chief health inspector by an average force of 145 regular and emergency sanitary inspectors. During the year there were made 1,954,990 inspections and reinspections of houses; 241,806 houses were cleaned as a result of sanitary inspection; 1,196 houses were whitewashed and painted; 7,336 houses were disinfected; 82 houses were condemned and removed; 11,256 cesspools and vaults were cleaned; 161,447 cleanings of yards were carried out; 1,757 yards were repaired, repaved, etc.; 534 cholera cases, 71 smallpox cases, and 185 plague cases were reported; 5,479 sanitary orders were complied with by householders; 246 persons were convicted for violation of food prohibition orders.

DEATH RATE OF MANILA.

Considerable difficulty has been experienced in establishing the death rate for the city, owing to uncertainty as to the precise number of inhabitants. The census originally taken by the board of health showed a population of 244,732. Subsequent estimates raised these figures to 250,000 and later to 302,154. Unquestionably there has been considerable fluctuation in the population, for when the provinces were in a disturbed state people flocked into the city for safety, returning again to their provincial homes as conditions improved. The recent official census shows a population of 219,941.

The director of the census has stated that the figures 244,732 may be considered approximately correct for the period prior to the official census, and all rates figured before June 30, 1903, on higher estimates have been recomputed on this basis. Since this time the official figures (219,941) have been used in all computations. These latter figures show that the population is made up of 189,782 Filipinos, 22,125 Chinese, 4,389 Americans, and 3,645 foreigners. The total deaths for the year were 8,392, giving an annual death rate of 37 to the thousand. Eight hundred and ninety-four of these deaths were due to cholera and 166 to bubonic plague.

The rate per thousand, by races, has been: Filipinos, 43.42; Chinese, 28.26; foreigners, 18.72; Americans, 14.80. Of the total deaths occurring in the city, including transients, 5,105 were reported as occurring in males and 3,906 in females.

In respect to age the deaths were as follows:

Under 1 year	3, 872
One to 10 years	1, 012
10 to 20 years	400
20 to 30 years	1, 080
30 to 40 years	1, 020
40 to 50 years	646
50 to 60 years	501
60 to 70 years	405
70 to 80 years	209
80 to 90 years	113
90 to 100 years	71
More than 100 years	28

In 37 instances age was not reported.

INFANT MORTALITY.

It will be noted that a very high death rate among infants is the chief factor in the general result, 41.23 per cent of the total number of deaths having occurred in infants under one year of age. For the month of June the deaths reported from "convulsions of children" alone exceeded the combined mortality from Asiatic cholera, bubonic plague, smallpox, malarial fevers, typhoid fever, and beri-beri. This shocking infant mortality is largely the result of ignorance concerning their proper care and feeding and difficulty in obtaining suitable food for those who can not be nursed by their mothers. A frequent source of death among them is tetanus, resulting from infection of the umbilical chord at birth by reason of improper dressings.

The problem of reducing infant mortality in Manila and the provinces is one which should be seriously and promptly attacked. Something can be done by educating the mothers; and more, in the imme-

diate future, by employing properly trained midwives and nurses. It is in my opinion a matter of the greatest importance that a training school for Filipino nurses should be established as soon as possible.

DEATH RATE IN DIFFERENT DISTRICTS OF THE CITY.

Ermita, in which reside a large population of whites and Filipinos of the better class, has been the healthiest district of the city. Its death rate was 19.22, which is about that of the most healthful modern cities. Districts with a large Chinese population show a much lower death rate than those chiefly populated by the poorer class of Filipinos. Paco, with a death rate of 88.32, was the most unhealthy district, and the cause of the high mortality there should be made the subject of early investigation.

LACK OF MEDICAL ATTENDANCE.

Forty-eight and three-tenths per cent of the total deaths and still-births in Manila are reported to have occurred in the absence of any treatment by qualified physicians. Many of the more ignorant natives are fatalists, regarding disease as a thing which can be checked only by the will of God. For this reason, and because many do not understand that free treatment can be obtained from the Filipino and Chinese municipal physicians, a large part of the population goes without medical assistance of any sort, and this materially tends to swell the death rate.

Very substantial reduction in the death rate will result from better care of infants; a new water supply, which may be looked for in a comparatively short time; a general sewerage system; the improvement of the esteros, and the filling in of low lands.

BIRTH RATE.

The total number of births reported in Manila was 3,387, giving a rate of 15.39 per thousand. The returns are unquestionably very incomplete, and a large number of births have doubtless occurred which have not been reported. Improvement in reports was noticeable toward the end of the year, however, and it is hoped that reliable birth statistics may soon be obtained. The problem of securing them is complicated by the fact that among the Filipinos midwives or physicians are not summoned in the majority of cases.

NEED OF PUBLIC BATH HOUSES AND LAUNDRIES.

The commissioner of public health in his annual report strongly recommends the establishment of public bath houses and laundries. The evil results of bathing and washing clothing in the Pasig River and the esteros in time of epidemic disease have been conclusively demonstrated during the recent cholera epidemic. Even when the water is not infected with the germs of dangerous contagious diseases, it contains those of dhobie itch and other annoying ailments. No law prohibiting bathing or the washing of clothing in the river and esteros can be enforced until other facilities have been supplied to take the place of those of which the people would be deprived by such enforce-

ment. Public baths and wash houses should be established by the municipal authorities at convenient points with reference to centers of population. The structures need not be expensive, and the resulting improvement in public health would unquestionably be considerable.

A NEW WATER SUPPLY AN IMPERATIVE NECESSITY.

The commissioner of public health also strongly urges the necessity of a new water supply for the city. As a matter of fact, investigations preparatory to the providing of such a supply are now in progress. The work should be pushed forward with all possible haste. The frightful danger to which the city has been exposed throughout the recent cholera epidemic by drawing its water from a stream with three populous towns along its banks above the intake has been a constant and heavy strain upon those responsible for safeguarding the public health. We have been extraordinarily fortunate in escaping a general infection of the water supply with the germs of cholera, which might readily have resulted in 100,000 deaths in the city, and could hardly hope to be so fortunate again.

Apart from the danger in time of water-borne epidemic diseases, the present water supply, coming as it does from a river with 20,000 people living in its valley above the intake, is foul and unfit for drinking purposes unless subjected to careful preliminary filtering or boiling. Furthermore, the pressure is insufficient. In many parts of the city at certain times of the day water can not be drawn on the second floors of houses. The engines at the pumping stations are antiquated and, when all of them are worked at their full capacity, supply only 40 gallons per day per capita, a quantity insufficient to meet existing municipal needs for domestic and manufacturing purposes. The present reservoir holds but one day's supply for the city, so that a temporary breakdown of one or more of the old engines now in use would result in a water famine.

The present distribution of water is unsatisfactory, especially in the districts inhabited by Filipinos of the poorer class, many of whom would have to carry water for such long distances if they obtained it from the city mains that they are practically forced to dig wells, which invariably become contaminated, or to draw water for domestic purposes from the filthy esteros. In time of fire there is often not sufficient water to bring flames under control and costly conflagrations result. It can unhesitatingly be stated that the greatest immediate sanitary need of the city of Manila is an adequate supply of pure water.

The question of water supply became especially critical during the past year when the town of Mariquina was destroyed by fire. Some four thousand homeless people crowded down among the trees on the river bank and erected temporary shelters for themselves. They had no sanitary facilities, and contamination of the river with nightsoil was inevitable. Cholera prevailed in neighboring towns, and danger of a general epidemic in Manila, due to an infected water supply, was obviously very great. The board of health displayed its usual energy and efficiency in dealing with this situation, taking control of the Mariquina watershed and securing the assignment of a large number of United States troops as a water guard and the detail of a company of constabulary as sanitary police.

American and Filipino sanitary inspectors with a detachment of disinfectors were sent from Manila; the refugees were moved away from the river and provided with tents; the pail-conservancy system was installed to prevent water pollution from nightsoil, and the whole sanitary service was placed under the control of a medical officer. By these means the danger was averted.

FOUL WELLS IN MANILA.

The wells of Manila are an abomination. Water is usually encountered at a depth of 3 to 4 feet below the surface, and its character can readily be imagined. Many of the wells are mere excavations in the soil, without walls or facilities for lifting the water, and are constantly contaminated by surface washings. Others are stoned up and protected to some extent against surface drainage, but the quality of water obtained from all shallow wells is bad, owing to the high degree of pollution of the soil. All wells were closed by my order at the time of the cholera epidemic in 1902. Authority has since been granted for the reopening of a few of them to supply water for domestic purposes other than drinking, cooking, and washing dishes, but when an adequate city water supply has been provided all shallow wells should be permanently closed.

SEWER SYSTEM.

Manila is an unsewered city. The few old drains of Spanish construction, traversing some of the more densely populated districts, are rectangular in cross section and are made of loose slabs of stone between which liquid contents readily escape. They are laid without regard for proper fall and the avoidance of undue friction. Earth works into them through cracks between the stones, so that they soon become choked. At best they discharge only on a falling tide. Most of them empty into esteros, and, far from being of use, they are a positive menace to the public health. It will be a difficult and expensive matter to establish an adequate sewer system for the city, but such a system is, next to a pure-water supply, the city's greatest sanitary need.

The existing esteros or tide creeks should be retained and improved, in order to carry off the enormous quantity of rain water which falls during typhoons and to facilitate water transportation. The sewer system proper should be for the removal of excreta and liquid waste from houses and manufactories. A combined system for the removal of these substances and of storm water would seem to be quite impracticable.

Much has already been done to improve the sanitary condition of the esteros. Under Spanish rule practically all excreta, garbage, and manufacturing waste were deposited in them, and they were merely very foul open-air sewers. The removal of garbage by the municipal authorities, the abolition of many of the privies over esteros, the removal of excreta in conservancy pails, and the insertion of septic tanks in many private drains, so that their discharge is considerably purified before entering the esteros, have led to much improvement; but conditions are still highly unsatisfactory, and must so remain until a general sewer system has been constructed and the esteros have been

dredged and walled and adequate means of flushing them have been provided. At present the outflow and inflow, due to the fall and rise of the tide, result only in the oscillation of foul water from one portion of the estero system to another, without sufficient purification by discharge to offset the pollution constantly going on. It is only during the rainy season that the esteros are properly flushed, and their condition towards the close of the dry season becomes shockingly bad. They are, however, absolutely necessary to carry off storm water during the rainy season, and are of great economic value, affording ready access by water to all of the more important parts of the city, thereby greatly cheapening and facilitating transportation. If their contamination by sewage and organic waste can be prevented they will be of great value to the city.

PLAN FOR IMPROVING THE ESTEROS.

Dr. E. L. Munson, assistant to the commissioner of public health, has suggested a plan for the flushing of the esteros during the dry season which is well worthy of practical trial. His idea is to control the tidal action in the esteros by outflow gates near their mouths and inflow gates near their heads in such a way as to cause a constant movement of their water toward the lower portion of the Pasig River so that they will discharge on the ebb of the tide, comparatively pure water for filling them to be drawn from higher up the river when the tide rises. The closing of the inflow gates at the proper time would prevent any escape of the cleaner water except by traversing the esteros, and the opportune closing of the outflow gates would prevent any reentrance of foul water. It would be necessary to dig three short inflow flushing canals in order to perfect the operation of the system throughout the entire city. It is estimated that the cost of the necessary flushing canals and tidal gates would be but \$15,000. If a steady flow could be had during a part of the day only from the heads of the esteros into the river, it would be an enormous improvement. At present the accumulated filth of the esteros is forced back into the outskirts of the city by the rising tide and drawn down into the commercial and residence districts by the falling tide, while comparatively little of it finds its way into the river except during violent rain storms.

Ultimately the esteros should be provided with solidly built valve gates to insure the proper purifying movements of the water. They should also be straightened where practicable, dredged to a sufficient width and to a uniform depth of 4 feet at low tide, so that mud banks may never be exposed, and walled up with stone.

SUNKEN LANDS IN MANILA.

There are considerable areas of sunken and marshy lands within the city which should be filled as rapidly as possible. At present they are in many instances alternately flooded by filthy estero water and uncovered. They afford ideal breeding places for mosquitoes. They are evil smelling and unsanitary, and in many instances constitute nuisances which might well be abated at the expense of their owners, who would be well recompensed for the expense involved by the resulting increased value of their lands. The commissioner of public health believes that ashes from the shipping at the wharves and from manu-

factories, crematories, breweries, etc., should be used for improving these lands, and that no material which could advantageously be used for filling should be removed from the city or dumped into the bay. I heartily concur in this opinion.

DISPOSAL OF GARBAGE.

The collection and disposal of garbage and refuse is at present performed by the department of streets and parks, under the direction of the city engineer, but the sanitary inspectors of the board of health take cognizance of any failure to properly conduct this work. Garbage is taken to the crematory, where it is sorted and destroyed. Property owners are required to deposit their garbage in water-tight metal containers. These, together with receptacles for other refuse, must be set out on the street in front of the premises for collection not earlier than 9.30 p. m. or later than 5 a. m. This system is effective and has greatly facilitated the work of safeguarding the health of Manila.

DISPOSITION OF NIGHT SOIL.

The collection and disposal of human excreta is by law placed under the direction and control of the board of health. The work is partly performed by employees of the pail conservancy system and partly by private contractors. Vaults and latrines are emptied by employees of the pail conservancy system only at night, and odorless excavators are used for this purpose. The private scavengers are not properly equipped for doing such work and still employ unsanitary methods. Night soil is disposed of by dumping it into the bay outside of specified limits. There is reason to believe that employees of private contractors sometimes dump the cargoes of their crafts into the esteros or the Pasig River under cover of night. This work should be entirely taken over by the board of health when sufficient equipment is available for carrying it on.

The operation of the pail conservancy system has, on the whole, been satisfactory. Experience shows that in providing for the disposal of the excreta of the poorer class it is usually preferable to group the pails for a number of houses in a latrine open to the general public rather than to make individual installations. In the public latrine pails can be properly looked after by an attendant, and much of the time which would be required for their collection and distribution over wide areas is saved. The cost of operating such latrines must, obviously, be paid from the public treasury, but most of the people who use them would be too poor to pay for private installations.

The scavenger barge *Pluto*, especially constructed to serve as a dumping boat for the pail conservancy system, has been received. She is a vessel of 285 tons burden, and can go out into the bay in all reasonable weather and dispose of her load at a point sufficiently distant from the shore to render impossible the casting up of foul matter on the beach. The *Pluto* will receive all night soil which is removed by private scavengers.

CONGESTION IN POPULOUS DISTRICTS.

A material improvement in the sanitary condition of the city may be expected when the installation of the electric street-car system now

under construction is completed. There is great congestion of population in many parts of the city, especially in those districts inhabited by the working class. This is largely due to the necessity of living near one's place of employment, felt at present by every person who is not possessed of sufficient means to afford a horse and vehicle or a considerable daily expenditure for carriage hire. It would involve great hardship were we to thin out the overpopulated districts at present and compel a considerable number of their inhabitants to find homes at a distance from their places of employment. When the street-car system is in operation the work of gradually removing the more unsanitary habitations from overcrowded districts should be undertaken, and reasonable requirements as to amount of space left between buildings should be insisted upon.

THE FLOATING POPULATION OF MANILA.

Much trouble has been caused the board of health by the floating population of Manila, consisting of about 15,000 souls who reside upon *cascos*, *lorchas*, launches, and other small vessels plying on the river, the *esteros*, and the bay. They are an unruly set and are difficult to keep under supervision on account of the constant movements of their floating habitations. It has not proved practicable to prevent their polluting the river and the *esteros* with refuse and excreta, nor can they be restrained from using infected waters for drinking, cooking, and bathing. Cholera has occurred among this class to a larger extent than among any other class of the population. Only too often they hurry their sick ashore and abandon them or weight the bodies of the dead and drop them into the water at night in order to escape having their crafts disinfected. The sanitary problems presented by this floating population are very difficult of solution. They can not well be compelled to take up their residence ashore, nor can their vessels be obliged to anchor in the bay. They might be compelled, during the daytime at least, to make use of public latrines situated at convenient points on the shore. An adequate supply of good drinking water should be made available for them at convenient points so that they may have no excuse for drinking river water. During the year a launch has been kept in constant use by the board of health inspecting the carrying out of sanitary work among these denizens of the bay, river, and *esteros*.

SANITARY MARKETS AND UNSANITARY FOOD SHOPS.

The admirably constructed and sanitary markets erected in Manila under American rule have been an important factor in limiting the spread of cholera and other diseases in the city. It is easy to inspect them, and they are kept for the most part in excellent condition. It is a far more difficult matter to keep in a proper state the 1,100 shops or *tiendas* where a large number of poor people habitually take their meals. The sanitary condition of these shops has been greatly improved through inspection and refusal of renewal of licenses to establishments which offend most seriously, but their condition is still unsatisfactory. The work of inspecting foods and drinks, and establishments for their preparation and sale, has been especially heavy during the continuance of the cholera epidemic. The lower-class Filipino seems unwilling to

purchase an article of food without first handling it, and the infection of cholera has unquestionably been frequently transmitted in this way. Handling of food was therefore prohibited, and vendors were required to supply forks for the use of possible purchasers. Flies having been found to be quite generally infected with cholera bacilli, the protection of food by proper fly screens was insisted upon.

During the epidemic the use of some 40 articles of food was, at different times, strictly prohibited. Fruits not of an acid character and usually eaten raw and unpeeled, vegetables used for salads, mollusks, and a considerable number of the mixed foods used by Chinese and Filipinos which were especially likely to carry infection, have made up the prohibited list, which could not be increased to the limit theoretically desirable without inflicting excessive hardship upon the poorer classes.

NEED OF A GENERAL HOSPITAL.

There is a great need of a general hospital in Manila. The army has made adequate provision for its sick, and the civil government has also provided adequate hospital facilities for civil officers, employees, and members of their families, but the closing of the Woman's Hospital and the Maternity Hospital during the past year has left no place where modern hospital facilities can be had by any considerable proportion of the sick of Manila who are not connected with the army or the civil government.

While the beds not occupied at a given time in the civil hospital have been made accessible to the general public, they are grossly insufficient in number to meet the existing need. A site for a general hospital has been selected on the exposition grounds conveniently near the site of the new building for the bureau of government laboratories, from which it can be supplied with light and power. The commission has expressed its purpose to construct and maintain such an institution, and it is earnestly hoped that there may be no delay in undertaking the work of erecting the necessary buildings. The hospital should be constructed on the pavilion plan, and should be provided with surgical amphitheater, autopsy amphitheater, and clinical rooms, to be used in connection with a medical school when established.

CONTAGIOUS-DISEASE HOSPITALS.

During the year the several hospitals for contagious diseases on the San Lazaro estate have been placed under the control of one man. The commissioner of public health reports that increased efficiency has resulted, and that the administration of the several hospitals have been in many ways improved.

There has been great improvement during the year in facilities for the treatment of contagious diseases. Through the public spirit and generosity of Chinese merchants, funds were contributed for the construction of a well-built and modern pavilion hospital for plague cases and of a small building for a reception ward. It is planned to erect additional separate buildings for the treatment of Chinese cholera and smallpox patients. The nipa buildings, formerly used for the detention of contagious-disease contacts, were destroyed in the great Trozo fire. On the site which they occupied modern hospital buildings are

being erected on the detached pavilion plan, capable of properly caring for all classes of contagious disease. These buildings should be ready for occupancy early in October.

NEED OF INSANE ASYLUM.

A hospital for the insane is greatly needed. The provinces are entirely without facilities for caring for this class of unfortunates. At Manila the Hospicio de San José, at present conducted by the Catholic Church, accommodates about 300 persons, but this institution is crowded to the limit and is wholly inadequate to meet even the local need. As a result the insane among the Filipinos throughout the islands are necessarily cared for in the houses of their friends or in the provincial jails. The board of health has often been compelled to take charge of insane persons who were transients, or friendless, or whose condition was such as to make them dangerous, and has been obliged to bring them into a police court, charge them with disorderly conduct, and procure their incarceration in Bilibid prison in order to secure decent care for them. This method of procedure, though necessary, is deplored by those who employ it, and the providing of an adequate hospital for the care of the insane must be regarded as an urgent necessity.

LEPER COLONY.

Work on the leper colony at Culion has progressed unsatisfactorily, owing to labor difficulties, and it has been deemed preferable to withdraw government employees and material from the island and let the work of construction to private contractors. During the year the Philippines have suffered from what is said to have been the worst drought in half a century. The governor of Paragua reported to the commission that the water supply at Culion was insufficient for the proposed colony. Engineers were hurried to the island to thoroughly investigate this matter. Wells were sunk and one of them developed a fine flow of water at moderate depth. The rains began before the experiments of the engineers were finished, but the conclusion was reached that a water supply adequate even in time of drought could be developed.

FREE DISPENSARY.

A free dispensary is operated by the board of health. Six thousand six hundred and fifty-eight prescriptions, practically all of which were for Filipinos, were filled during the year. This number is very small. The less intelligent Filipinos disbelieve in the efficacy of medicines, and trust rather to that of prayer, and the fact that there is but one dispensary and that transportation is at present expensive and difficult to obtain is also an important factor in the general result.

NEW MORGUE.

Until within a short time the only morgue facilities in the city were afforded by tents located on the San Lazaro Hospital grounds. Recently a thoroughly modern morgue building, ample in size to meet all the needs of the city, has been completed.

LOSS OF PROPERTY IN TROZO FIRE.

In the destructive Trozo fire, which occurred in May, 1903, and rendered about 20,000 persons homeless within a period of two hours, the board of health corral, buildings of the pail conservancy system, cholera hospital, and detention camp were destroyed, together with practically all the property which they contained, or which was on the ground adjacent to them, except public animals, involving a total loss to the board of health of more than \$45,000, United States currency. The emergency this presented was promptly and effectively met by the board, and its operations were interrupted for a period of but twelve hours. On the following day the board supplied tentage to all homeless people who had been unable to secure shelter. Before the natives would use the tents it was necessary to post notices on each to the effect that no charge would be made for occupying it. A sanitary organization was created for the burnt district, temporary latrines were established, and the high rate of sickness which usually follows catastrophes of this sort was averted. This is but one of several occurrences during the year which have demonstrated that the board of health is not only able to cope with the difficulties which constantly confront it, but can and does successfully meet great emergencies.

UNHEALTHFUL CONDITION OF BILIBID PRISON.

The commissioner of public health calls attention in his report to the unhealthfulness of Bilibid Prison. It appears that there were 213 deaths among the convicts, with an average daily number of 2,152 imprisoned. This gives an annual death rate of 99 per thousand, which is nearly three times greater than that for the general population of Manila during the same period. This death rate is highly excessive, and its cause should be made the subject of immediate and searching investigation.

BOARD OF HEALTH SUPPORTED BY MANILA COURTS.

The board of health has received assistance of the utmost value in the enforcement of sanitary laws from the courts of Manila, and the belief which seems to have existed in certain quarters that these laws would not be enforced against wealthy and influential persons has been shattered. Without such judicial support the sanitary work of the city would have been paralyzed. Conditions have been less satisfactory in the provinces, where few convictions have been obtained.

SANITARY LAWS NOT SATISFACTORY.

The commissioner of public health, in his annual report, invites attention to the fact that the laws for the sanitary government of the city of Manila are incomplete, inconsistent, and do not properly meet the needs of the situation, and that the functions and powers of the board of health and its officials are much confused by the provisions of acts 157 and 183 of the Philippine Commission. In this connection it may with propriety be suggested that it is the function of the board of health for the Philippine Islands to draft necessary sanitary legislation for submission to the Commission, and that repeated requests

for drafts of acts which would remedy the existing situation have been made by me. It is therefore satisfactory to learn from the above-mentioned report that drafts of such laws as appear to be necessary have been prepared and are under consideration by the board. I trust that the legislation drafted by the board of health may soon be presented to the Commission.

LEGISLATION DRAFTED BY THE BOARD.

Acts regulating the practice in the Philippine Islands of dentistry, pharmacy, and medicine and surgery, the original drafts of which were prepared by the board of health, have been passed by the Commission during the past year. The board has also drafted:

An act regulating the manufacture and sale of aerated mineral and bottled waters, sirups, beers, or other drinks in which water is used.

An act providing for the safe and humane transportation of animals by water in the Philippine Islands.

An act relative to the immunization and movement of cattle and carabaos in the Philippine Islands.

An act relative to the quarantining of equines imported into the Philippine Islands, and for the control of surra or trypanosomiasis.

An act relative to the establishment of a training school for Filipino nurses.

An act providing for the quarantining and compulsory inoculation against rinderpest of horned animals in the Philippine Islands.

The board has also drafted and submitted to the municipal board of Manila an ordinance regulating plumbing; the issuance of plumbers' licenses; house drainage, and the making of openings in the streets; and an ordinance relative to the period of detention of smallpox and plague cases and suspects.

THE CHOLERA EPIDEMIC.

The cholera epidemic is at present wearing itself out in the more remote parts of the archipelago, with occasional active outbreaks at different points. The statistics have not yet been thoroughly digested, and a full discussion of the epidemic will be postponed until it is ended and can be treated as a whole. Some general facts can, however, be given at this time. Up to September 1, 1903, there were officially reported for the islands 157,036 cases of cholera, with 102,109 deaths. These numbers probably do not represent more than two-thirds of the cases and deaths which have actually occurred. Many towns were without physicians or other persons capable of recognizing cholera, so that numerous cases were not properly diagnosed. Many of the municipalities had no sanitary organization, and no statistics are available with reference to the mortality among the Pagan tribes. In numerous instances the sick were concealed and false statements were made as to the cause of death, so that official returns, where they exist, can not be accepted as complete.

The epidemic eventually spread to nearly every part of the islands. Land quarantines were usually ultimately ineffective, although there was a noteworthy exception in the case of the province of Lepanto-Bontoc, which can be entered only by a few narrow mountain trails and was effectively protected by quarantine so that it escaped the disease completely. The province of Abra, somewhat similarly situated, was also fortunate, the number of cases being very limited.

As stated in my previous report, it was demonstrated over and over again that the disease could be stamped out in any town where the necessary men and means were available. Small native sailboats and canoes were the chief factors in disseminating the infection. It is in the nature of things impracticable to control their movements, and as the distances between islands are short the disease was readily spread in this way.

The total cases in Manila to date have been 5,112, with 3,958 deaths, giving a case mortality of 77.2 per cent. During the year there have occurred in Manila 1,179 cases, with 894 deaths, giving a case mortality of 75.8 per cent. There have been 3,309 cases and 2,568 deaths among males, and 1,789 cases and 1,384 deaths among females. In 14 cases the sex was not noted. These figures show that the number of males affected has been about twice that of females, due doubtless to the greater exposure to infection of the former while working on the water front and eating in the small shops where food is sold to laborers.

The cases in Manila have been distributed by races as follows:

Race.	Cases.	Deaths.	Case mortality. <i>Per cent.</i>
Americans.....	163	77	47.2
Europeans.....	63	35	55.7
Chinese.....	333	187	48.8
Filipinos.....	4,457	3,635	81.5
All others.....	35	22	62.8
Not stated.....	9	2	.....

These figures show a higher power of resistance to the disease for Americans than for any other nationality. The number of Chinese who have developed the disease is comparatively small, their relative immunity being doubtless due to the fact that they use chiefly cooked food and boil their water in preparing tea. The number of Americans who contracted the disease is disproportionately high, but the cases occurred chiefly among soldiers who defied military orders and sanitary regulations, and among loafers on the water front.

Curiously enough, the mortality statistics seem to show that the type of the disease during the latter part of the present year has been more fatal than that which prevailed last year, although we have had only one-tenth as many cases. These figures, in the opinion of the commissioner of public health, represent the result of a more effective sanitary organization of the city, where he thinks the natural conditions are fully as favorable to the development of a widespread epidemic this year as a year ago. It seems, however, that epidemics of cholera tend to be self-limiting, and it is possible that more importance should be attached to this element of the case than has been given it in the report referred to.

An investigation of the ages of the cholera victims shows that early adult life is the period in which recovery is most likely to occur, the mortality being highest among young children and aged persons. There can be no doubt as to the efficiency of the organization which the board of health has had in the field for fighting cholera and bubonic plague in Manila, and the commissioner of public health and his colleagues are certainly to be congratulated upon the results obtained. For a time cholera completely disappeared, but a recrudescence occurred with the beginning of the rains, a condition of affairs which was anticipated.

BUBONIC PLAGUE.

During the year there has been an epidemic of bubonic plague in the city, aggregating about 200 cases. It is believed by the health authorities to have been developed from some slight infection which maintained itself in the city subsequently to the energetic repressive measures carried out in 1901, which resulted in the development of but 9 cases of the disease in 1902. It is not, however, certain that the disease was not imported from abroad, as it has existed all along the neighboring Asiatic coast.

During the year plague has prevailed to an alarming extent in many of the cities of the world, and seems to have been increasing in severity. Considering that the manner of its appearance and early development in Manila has been almost identical with what has occurred in other oriental cities which have suffered severely, there is every reason to believe that a serious epidemic has once more been averted through the ability and energy of the members of the insular board of health and the effectiveness of the preventive measures employed by them.

SMALLPOX.

During the year there have been 99 cases of smallpox in Manila, with 16 deaths. Nine of these cases, with 4 deaths, occurred among Americans, a number of whom were not protected by vaccination. In the provinces several outbreaks of this disease have occurred; and those in the Cagayan Valley, in the province of Ambos Camarines and in several of the southern islands were particularly severe. In every case vaccinators were sent to the scene of trouble by the board of health if they could not be provided by the local provincial authorities, and excellent results were obtained where vaccination could be effectively carried out.

The reports of Señor Saturnino Espejo, chief vaccinator under both Spanish and American administrations, show the following vaccinations in Manila:

From November 3, 1894, to November 25, 1898 (four years and three weeks) .	9, 136
November and December, 1898 (two months)	10, 477
1899	103, 931
1900	60, 592
1901	68, 144
1902	96, 823
September, 1902, to September, 1903	154, 706

In other words, 70 per cent of the population have been vaccinated during the past year. Forty-three and six-tenths per cent of these vaccinations were successful. As these figures include many revaccinations, the excellent quality of the virus used is shown. No bad results are known to have developed from vaccination in any instance. Smallpox has ceased to be a factor of importance in the Manila death rate. The cases which occur are chiefly among transients not protected by vaccination, and the death rate for this class of persons is very high. Two American school teachers, recently arrived from the provinces, who had evaded vaccination, developed the disease and died.

Vaccination in the provinces is usually carried out by vaccinators under the provincial boards of health, but where provincial funds are not available for this work the necessary vaccinators are employed by the

insular board of health. Full returns showing the number of vaccinations during the past year are not as yet available, but 1,161,909 units of vaccine have been issued for use, and approximately one-eighth of the total population of the islands has been vaccinated. It is proposed to continue this work until the entire population of the islands is protected against smallpox, which was formerly the great scourge of the archipelago. At the present rate of progress the day is not far distant when this result will have been obtained.

SMALL NUMBER OF DEATHS FROM MALARIA.

Malarial disease is less common and dangerous in the Philippines than in many other tropical countries. The deaths in Manila from malaria during the year have been but 226.

DEATHS FROM DYSENTERY.

There have been 236 deaths during the year from dysentery, a disease which seems to result almost invariably from the use of impure water. The city water is unsafe and unquestionably carries the organisms which produce dysentery. When pure water has been made available for drinking purposes the mortality from this disease should rapidly decrease.

NUMBER OF LEPERS IN THE PHILIPPINES.

Continued investigations as to the prevalence of leprosy in the archipelago give reason for the belief that the number of lepers is smaller than heretofore supposed. The board of health has records of 3,323 lepers, and while its records are by no means complete, the commissioner of public health estimates the lepers in the islands at less than 6,000. At present but 434 are segregated in leper hospitals. Apparatus for the treatment of leprosy with the X-ray and the Finsen ray have but very recently been furnished the San Lazaro Leper Hospital, and no statement can as yet be made as to the efficacy of treatment with these rays.

BERIBERI IN MANILA.

Beriberi is one of the more important causes of death among Filipinos and Chinese, and is especially prevalent among the poorer classes. Very few cases of this disease occur among whites. There were 313 deaths from this cause during the year. A severe outbreak occurred among the convicts confined in Bilibid prison, but no white persons were attacked.

INSPECTION OF ANIMALS.

During the year 95,360 animals were inspected on arrival at the port of Manila by veterinarians of the board of health; 91,442 were inspected prior to slaughter, and 394 animals were condemned for disease and their bodies were cremated.

PREVENTION OF RINDERPEST.

Very important work for the prevention of rinderpest has been carried out during the year by agents of the board of health, the

bureau of government laboratories, and the bureau of agriculture. The method of simultaneous inoculation with the blood of diseased animals and a prophylactic serum has been so perfected that less than 2 per cent of the animals inoculated have succumbed as a result of the operation. The inoculation is effective in stopping the ravages of the disease, and the agents above referred to have been sent to points in the provinces where it has appeared and have carried out their work with marked success.

QUARANTINING OF IMPORTED ANIMALS NECESSARY.

The urgent necessity for the establishment of quarantine stations for animals imported has been made evident during the past year by the bringing in of that highly infectious and extremely fatal disease, hæmorrhagic septicemia, which was introduced in the month of May by a small herd of carabaos imported from Hongkong. Of the various animals exposed to the infection while en route and after arrival, all contracted the disease and died. Fortunately, its infectious nature and dangerous character were recognized before the infected herd had left quarantine.

With the extensive purchases of animals which the government is making abroad, especial care is necessary to prevent the introduction of dangerous epidemic diseases. Much difficulty has been experienced in securing suitable ground for a cattle quarantine station at Manila, but a tract on the range of hills near San Felipe Neri has finally been leased. Cattle will be taken up the river in lighters and unloaded on a wharf extending into the San Juan River near its junction with the Pasig. The lot is approximately 15 acres in extent, and will be divided into 10 sections by double fences. One section will be fitted up with inoculation stalls, and will contain the offices and feed house. The other 9 sections will be divided by single fences into 4 pens, each large enough to hold 50 head of stock. Each of these pens will contain a feed house, watering trough, and shed for sheltering the animals. The work on the station is being pushed rapidly, and it is proposed to establish similar stations at the earliest practicable time at the other ports of entry of the archipelago.

LOCUST PEST.

Very heavy losses have been inflicted upon agriculturists during the past year by the depredations of enormous flocks of locusts. The destruction caused by these insects has been a serious factor in the existing agricultural depression. Numerous attempts to destroy flocks of locusts by infecting them with fungous disease have been made by agents of the board of health. In a number of instances, especially during the dry season, these attempts have been without any apparent result. In other instances the use of the fungus has proved very effective. At the town of Dimiao, in the province of Bohol, for instance, locusts weighing approximately half a ton were destroyed. Young locusts not able to fly appear to resist the action of the fungus at all times, and can best be disposed of by driving them into trenches dug in the line of their march and burning them or covering them with earth.

The poor country people, for whom locusts are an important article of food, are, in many instances, opposed to their destruction.

Persons who eat locusts which have been infected with fungous disease suffer from severe intestinal irritation. The planters are naturally anxious to see an end put to the pest which so seriously damages their crops. The Commission has recently passed an act creating provincial locust boards and authorizing the calling out of practically every able-bodied man in a given locality, under severe penalties, for noncompliance to fight these pernicious insects. It is hoped that by these several means the scourge may ultimately be controlled. Neglect of proper restrictive measures during the long-continued period of disorder beginning in 1896 is undoubtedly responsible for the present serious condition of affairs.

SANITARY CONDITIONS IN THE PROVINCES.

The sanitary condition of the provincial towns, while greatly improved, is still very far from satisfactory. A serious difficulty is encountered in the lack of a sufficient number of Filipino physicians properly qualified for carrying on this work. Unquestionably one of the great needs of the archipelago at the present time is a thoroughly modern medical school. Numerous municipalities are without physicians of any sort, while the superstitious beliefs of many of the inhabitants as to the causes of contagious disease are a serious obstacle in the way of improving sanitary conditions. This difficulty must be patiently and persistently met. Many years will elapse before it can be overcome.

The presidents of provincial boards of health are, with very few exceptions, Filipinos. Among them are a number of men who have shown energy and ability. Others proved incompetent during the cholera epidemic, but it has not, in most instances, been possible to replace them, as the available material for these positions was practically exhausted by the original appointments. Pressure of work due to the cholera epidemic and other causes has prevented the exercise of the needed supervision over provincial boards of health by the commissioner of public health, but during the early part of the present year a number of medical officers were sent through various provinces for the purpose of examining into and reporting upon their sanitary and economic conditions and the efficiency or lack of efficiency of their health boards.

For further information relative to the work of the board of health for the Philippine Islands and the city of Manila, reference is made to the report of the commissioner of public health, which is appended hereto and marked Appendix A.

THE QUARANTINE SERVICE.

The importance of quarantine work in the Philippine Islands is well shown by the fact that during the past year there have arrived at the port of Manila 68 vessels with cholera on board, and that cholera developed on 37 other vessels during the time they were serving their outgoing quarantine.

The long duration of the cholera epidemic taxed to the utmost the resources of the quarantine stations and the strength of the quarantine officials. The thoroughness of the work performed is conclusively shown by the fact that of the 105 cholera-infected vessels disinfected

at the Mariveles quarantine station, only one developed the disease after being released from quarantine, and on that vessel it developed in the ship's hospital among dysentery patients.

Although plague has been epidemic at Hongkong and Amoy, the work of the quarantine officers at these ports has been so effective that it has not been possible to trace a single case of this disease in Manila to infection from without.

With a view to preventing the spread of plague, an effort has been made to fumigate with sulphur all vessels which enter the port of Manila, and few vessels have come in during the year which have not been fumigated at least once. This work has undoubtedly been of great value in preventing the spread of plague from Manila to other ports of the islands by destroying the rats and other vermin which carry it. Two vessels on which plague was reported to have occurred while they were lying in Manila Harbor were disinfected at the Mariveles station. No further cases occurred in either instance.

Five vessels arrived at Manila with smallpox on board. The disease was in each instance stamped out in the usual way.

Leprosy was detected on five vessels. Four of the cases, which were in transit to Hongkong, were sent to the San Lazaro Leper Hospital; the fifth, which came from Hongkong, was returned to that place.

The ports of Iloilo and Cebu have been supplied with floating disinfecting plants, so that it is now no longer necessary to send vessels infected with quarantinable disease from these ports to the Mariveles station, and heavy losses of time and money to ship owners are thus prevented.

As the history of epidemics in the islands prior to American occupation showed that some of them had entered from the south, a quarantine station was, after due investigation, opened at Jolo on the 6th of May, 1903.

Thirty thousand dollars have been appropriated by the Commission for the construction of a quarantine station at Cebu, and when this station is completed it is proposed to move the floating plant now at Cebu to Jolo.

Difficulty has been experienced during the year in properly caring for persons suffering from quarantinable disease who arrived at Iloilo on vessels. It is hoped that a quarantine reservation with adequate facilities for the detention of passengers, the disinfection of their effects, and the care of the sick may be secured there in the near future.

The Mariveles quarantine station has proved adequate to meet the strain thrown upon it by the cholera epidemic, except in the matter of facilities for housing steerage passengers. At present but about 800 can be accommodated, and existing facilities should be increased.

An important discovery of practical value with reference to the distribution of the cholera germ in the Pasig River was made by Assistant-Surgeon Long. It was noted that most of the cases which occurred on board vessels during the latter part of May were on those lying on the shallow side of the Pasig River or at other places where bends and turns rendered the water sluggish, and Doctor Long's investigations showed that cholera germs were present in large numbers at places where the water was sluggish, while few or none were found where the current was swift.

In addition to the disinfecting work previously mentioned, 119 vessels were disinfected because they came from infected ports. There is probably only one station in the world where more disinfection has been accomplished during the past year than at Mariveles.

In addition to the work above mentioned, the surgeons conducted physical examinations of masters, pilots, patrons, and engineers, and of the men who entered the insular coast-guard service, examining a total of 163 applicants, 11 of whom were rejected. Commencing with the fiscal year 1904, examinations of arriving aliens will also be made by this service.

The large amount of quarantine work performed in the Philippine Islands during the past year is shown in the following table:

	Manila.	Cebu.	Iloilo.	Jolo.
Vessels inspected	5, 861	3, 985	2, 232	.....
Vessels quarantined	355	377	157	126
Infected vessels disinfected	244	43	28	1
Vessels fumigated to kill rats	182	11	7	1
Bills of health issued	4, 270	1, 766	1, 722	92
Pieces of baggage disinfected	75, 739	2, 247	1, 847	.....
Pieces of baggage inspected and passed	23, 940	297	7, 189	.....
Number of crew detained in quarantine	11, 399	4, 482	1, 737	.....
Passengers detained in quarantine	16, 247	1, 319	1, 175	.....
Number of crew inspected	198, 885	74, 380	44, 973	4, 341
Passengers inspected	185, 171	22, 818	26, 371	3, 359
Persons vaccinated	4, 647	125	932	.....
Persons bathed and effects disinfected	25, 862	844	741	.....
Suspects and contacts quarantined at least five days	8, 973	873	868	.....
Number of cases of quarantinable disease detected on vessels:				
Cholera	115	46	28	.....
Smallpox	7	3	2	.....
Plague	2	.....	.....	.....
Leprosy	6	1	.....	.....

Dr. J. C. Perry, who had from January 17, 1900, faithfully and efficiently discharged the duties of chief quarantine officer for the Philippine Islands, was succeeded on March 23, 1903, by Dr. Victor G. Heiser, who prepared the accompanying excellent report of the quarantine service for the present year (Appendix B), to which reference is made for further information relative to the quarantine service in the Philippine Islands during that period.

THE CIVIL HOSPITAL.

The work of the civil hospital has been highly satisfactory during the year, although the strength of the working force has been at times very greatly overtaxed as a result of the closing of the women's hospital and failure to carry out the plan for a general hospital for Manila supported by private funds. It was therefore necessary to open the civil hospital to the general public, with the proviso that in case of overcrowding civil officers, employees, and members of their families should be given preference in securing admission.

The position of assistant attending physician and surgeon has been abolished, and an additional house surgeon has been provided for.

The total number of patients admitted to the hospital during the year was 1,915. Of these 92 were treated by outside physicians.

To meet the increased burden of work imposed by the admission of patients other than civil officers, employees, and members of their families the number of nurses has been augmented.

The equipment of the hospital has been considerably increased, and now leaves little to be desired. The ambulance service has been greatly improved. The hospital stables are connected with the police and fire-alarm system. The ambulance horses have been, through the kindness of Chief Bonner, of the fire department, trained like fire-engine horses. Drop harnesses and chains have been provided, and the loss of time in reaching emergency cases has thus been reduced to a minimum.

Better quarters than those heretofore available have been secured for the nurses, who have continued to render faithful and efficient service which has contributed in a large degree to the success of the institution.

It would seem that little could be done to increase the efficiency of the existing institution in its present quarters. I desire, however, to emphasize the fact that the accommodations which it affords, while sufficient for civil officers, employees, and members of their families, are grossly inadequate to meet the needs of the other inhabitants of the city of Manila. The necessity for a large general hospital, constructed on the pavilion plan, is most urgent. Plans for the establishment of such an institution are at present under consideration, and it is hoped that the work of carrying them out may at least be actively begun during the coming year.

For detailed information with reference to the work of the civil hospital, and especially with reference to the number and character of cases treated by the hospital staff, attention is invited to the annual report of the attending physician and surgeon, which is appended hereto and marked Appendix C.

During the year a savage attack was made upon the administration of the civil hospital, and especially upon the attending physician and surgeon in charge, by the police surgeon of the city of Manila, who brought charges of the gravest nature against the attending physician and surgeon. These charges were at first couched in general terms, without names, dates, or other facts upon which an investigation could be based. Eventually, and after repeated requests from me that they be made specific, they were preferred in written form, and in such detail that an investigation was possible. I devoted my afternoons for several weeks to the hearing of witnesses cited by the police surgeon and such other witnesses with a knowledge of the facts as could be secured.

The investigation clearly demonstrated the fact that the more serious of the charges against the attending physician and surgeon were not only wholly false, but were malicious in the extreme; and upon my recommendation, concurred in by the civil governor, the police surgeon was dismissed from the government service.

THE CIVIL SANITARIUM AT BAGUIO, BENGUET.

The substantial improvement made in the Naguilian trail during the past year has rendered it comparatively easy to send convalescents to the civil sanitarium at Baguio, and the establishment of a well-equipped constabulary commissary depot at that place has greatly facilitated the securing of supplies. It has not been feasible, however, to provide a thoroughly satisfactory diet for the sick, owing to the difficulty of getting a sufficient and regular supply of fresh meat, poultry, and eggs, and the impossibility of securing milk. The pur-

chase of milch cows for the sanitarium has now been authorized, and the raising of poultry should be systematically undertaken.

Practical experience with patients sent to the sanitarium during the past year has confirmed the conclusion previously reached that substantially the same results are obtained which would come from a transfer for the same length of time to some temperate region in the United States.

During the sojourn of the Philippine Commission at Baguio in May and June, 1903, all available space in the sanitarium not occupied by patients was utilized by employees of the Commission. Action has been taken by the Commission providing for a twenty-room addition to the present building during the coming dry season.

CHANGE IN RATES AT THE SANITARIUM.

The charges for accommodation at the sanitarium have been lowered by the Commission upon my recommendation, and are at present \$1 per day for patients in wards and \$1.25 to \$1.50 per day for those in private rooms, but a charge of \$3 per day is made for private rooms reserved for one person. It has been made optional with me to remit all charges in the case of persons earning a salary of \$1,500 or less per year. It is the purpose of the insular government to render it feasible for any officer or employee who needs a temporary change to a temperate climate to get it promptly and at a cost within his means.

GOVERNMENT COTTAGES ON SANITARIUM GROUNDS.

Five comfortable cottages have been erected in the neighborhood of the sanitarium for rental to civil officers and employees in search of a change of climate for themselves or their families. All of these cottages were used during the stay of the Commission at Baguio, and two of them have been rented for the coming year. A third has been assigned to Maj. L. W. V. Kennon, in charge of the Government improvements in Benguet, and a fourth to Dr. J. B. Thomas, the physician and surgeon in charge of the sanitarium, in recognition of his faithful and efficient services.

REORGANIZATION OF SANITARIUM EMPLOYEES.

It has proved difficult satisfactorily to organize the force of employees at the sanitarium, for the reason that during the hot season at Manila and the period of residence at Baguio of the Commission the institution is sure to be overcrowded, while it is likely to be almost empty during the rains of August. With a view to meeting this difficulty the force of employees was materially increased at the sanitarium. I was at the same time empowered to transfer any employee of the sanitarium to the civil hospital at Manila, and vice versa. This will enable me at will to cut down the force at the sanitarium and augment that of the civil hospital at Manila, the employees of which are often overtaxed, and at the same time will render it possible for me to send to Baguio employees of the civil hospital who are in need of a change. This arrangement should greatly increase the efficiency of the working force of both institutions.

NEW SANITARIUM BUILDINGS NEEDED.

With the establishment of the summer capital at Baguio and the opening of through rail communication with Manila, the importance of the civil sanitarium will be greatly increased. The present building is better adapted to serve as a boarding house and dormitory than as a hospital. The attending physician and surgeon in charge believes that a suitable tract of land within the Government reservation should be set aside for modern hospital buildings on the pavilion plan, and that provision should be made in the near future not only for the class of patients who are at present sent to Baguio but for tuberculosis patients and maternity cases. I heartily concur in this opinion. When rail communication has been established, it will doubtless be desirable to send to Baguio most surgical cases other than those requiring immediate treatment, as recuperation will be much more rapid and danger of infection less than at Manila. In planning for new hospital buildings adequate provision should certainly be made for the performing of a considerable amount of surgical work.

IMPROVEMENT OF SANITARIUM GROUNDS.

Under the able direction of Mr. Thomas Hanley the sanitarium grounds have been greatly improved during the past year, and the sum of \$2,500 United States currency has been appropriated for their further improvement.

WORK OF THE SANITARIUM.

Many of the persons who have entered the sanitarium were in need of a change of climate but could not properly be classed as patients.

The sick persons admitted numbered 54. Of these 26 were discharged cured, 25 improved, 2 not improved, and 1 died. The patient who died had a fractured and badly crushed leg.

Among those who derived complete relief from ailments which would probably have necessitated departure from the islands, had not this delightful mountain resort been quite readily accessible, were Governor Taft and myself.

For further information as to the work of the sanitarium during the past year reference is made to the report of Doctor Fales, the acting attending physician and surgeon in charge during the absence of Dr. J. B. Thomas, who has returned to the United States on leave, which is appended hereto and marked Appendix D.

THE FORESTRY BUREAU.

There has been a continuance during the past year of the steady development and improvement which have characterized the work of the forestry bureau from the time of its organization. The service was established on April 14, 1900, by Capt. George P. Ahern, the present chief of the bureau, assisted by 8 men. At the end of the first year the force numbered 84 men and the revenue collected amounted to \$199,373.11, Mexican. At the close of the second year the force had increased to 125 men. The revenue collected during this year amounted to \$348,073.08, Mexican. At the close of the third year the authorized force amounted to 224 men. The revenue collected during the year

was \$527,414.85, Mexican. From these figures it appears that the steady increase in the force of employees has been accompanied by an equally steady increase in the revenue collected. When the better protection afforded the government forests by this augmentation of the force of employees is taken into account, it will be seen that the money spent upon their salaries has been well invested.

MODIFICATIONS IN FORESTRY LAWS.

A modification was made in the uses to which the revenues derived from forest products are put by act No. 527, which provides that the expense of conducting the forestry bureau shall be deducted from the total collections and that the balance shall be returned pro rata to the provinces and municipalities where were produced the products on which the collections were made.

Other provisions of law fixed penalties for the unlawful cutting or destruction of timber on military reservations, made the botanist of the bureau of agriculture also the botanist of the forestry bureau, and authorized the employment of six school-teachers as collaborators of the forestry bureau during their school vacations. The six teachers authorized were appointed, but the work of four of them was unsatisfactory.

NEW EMPLOYEES OF THE FORESTRY BUREAU.

Mr. Parker T. Barnes was selected as collector of forest botany after a competitive examination held in the United States. He arrived at Manila December 28, 1902, and has since been almost continuously in the field doing very satisfactory work.

A cabinetmaker, Mr. T. J. Piffard, appointed manager of the workshop, arrived in Manila in November, 1902, and was followed in June, 1903, by Mr. John Richter, an assistant. By act No. 807, passed July 27, 1903, the chief of the forestry bureau was authorized, for the purpose of promoting the proper treatment of woods in cabinetmaking and other allied arts and the making of fine furniture as a trade in the Philippines, to carry on in a limited way the finishing of furniture and manufactured articles of wood and to make a reasonable charge therefor, depositing and accounting for the receipts from this source in the usual way. It is hoped that by this means valuable practical demonstrations of the utility of many of our more important woods in cabinetmaking may be made.

VISIT OF THE CHIEF OF THE UNITED STATES BUREAU OF FORESTRY.

A valuable stimulus was given to the forest service of the Philippines by the visit of Mr. Gifford Pinchot, Chief of the United States Bureau of Forestry, who arrived in Manila late in October, 1902. Mr. Pinchot, at the request of the insular government, submitted a report on forest conditions and the forest service, after a rapid but thorough inspection of both, during a trip lasting somewhat more than six weeks. On his return journey he drafted, with the assistance of the chief of the forestry bureau, a series of letters full of valuable suggestions for presentation to the Commission, covering such subjects as organization of the forestry bureau, Philippine forest school, Philippine forest exhibit, forest policy, conduct of forest business, and steamer for making inspections.

Mr. Pinchot was also requested to suggest amendments to the existing forest regulations, which are embodied in a military order that has never been interfered with by the civil government. Aided by the chief of the bureau, he elaborated a proposed forest act, now before the Commission for consideration, which seeks to insure that "the public forests and forest reserves of the Philippine Islands shall be held and administered for the protection of the public interests, the utility and safety of the forests, and the perpetuation thereof in productive condition by wise use."

This act contains a provision for granting licenses for five or ten year periods, as well as for the present one-year period. It is hoped that the possibility of securing licenses for longer terms will act as an inducement for logging and milling companies to operate on a large scale. Provision is also made for reduction of government charges on forest products in provinces distant from Manila where large stands of timber exist, as well as in provinces where foresters select and mark all timber for felling.

DIVISION OF INSPECTION.

The efficiency of the division of inspection has been greatly increased by substantial additions to the force. On September 1, 1902, there were employed 5 assistant inspectors, 10 assistant foresters, and 52 rangers. The present authorized force consists of 4 inspectors, 20 assistant inspectors, and 128 rangers. Difficulty is encountered in securing men for these places as rapidly as they are needed. The number of forest stations has been increased within the year from 42 to 55.

DIVISION OF FOREST MANAGEMENT.

The division of forest management has within the past year examined forest tracts in northern Bataan and southern Zambales, on the Pacific coast of Tayabas, the southern coast of Tayabas, in the vicinity of the Gulf of Ragay, Camarines Norte, and in Masbate, Mindoro, and the province of Batangas, in order to secure data for the intelligent granting of timber licenses. The investigation has in each case covered the species present, their relative abundance, their power of reproduction in virgin forest and where clearings have been made, the lumbering methods in vogue, the accessibility of the timber, labor conditions, and current price of timber.

This work is now carried on by six foresters and two assistant inspectors. As a rule, no two concessioners are allowed to operate on the same tract of land. Inspection is thus made easier, and the licensee has the exclusive benefit of any logging trails or other improvements made by him. When licenses have been issued, the forester marks timber for cutting in the regions covered by the several licenses. A forester can mark 5,000 to 6,000 cubic feet per day, but this amount can be greatly increased by allowing him one or two assistants.

Each field party has devoted more or less time to the gathering of material for the Louisiana Purchase Exposition. Particular care has been exercised in the marking of timber for cutting in the vicinity of Baguio, Benguet, where it is especially desirable to cut only trees the removal of which will actually improve the forest, but where the temptation to wholesale depredations on the part of licensees is strong, owing to the great demand for lumber. An investigation was also

made of the forest region near the Gimogon River in western Negros, where the electric company of Iloilo is operating a modern wire cable system in the forest.

NEED OF A STEAMER TO FACILITATE INSPECTION.

In order to render possible satisfactory inspection of the manner in which its forest officials scattered throughout the archipelago perform their duties, it is important that a small steam vessel should be at the disposal of the forestry bureau. On May 1, 1903, the coast-guard cutter *Marinduque* was furnished the bureau for this purpose, but after she had made two trips she was assigned to other duty. Later the launch *Philadelphia* was turned over to the forestry bureau. She was in need of repairs, but will soon be ready for active service.

LICENSES.

Licenses are at present, as a rule, granted for a period of one year, beginning with July 1, and are issued free of charge, the government deriving its revenue from the dues on the forest products gathered. They are of four kinds, "timber," "firewood," "gratuitous," and "minor products."

A card index is kept of all licenses and of all persons violating forest regulations. Applications for licenses must go through the local forest station for remark by the local forest official, who furnishes information relative to the status of the applicant, his equipment for logging, etc.

Foresters and inspectors have authority to issue direct licenses to cut firewood and gratuitous licenses for timber for house building. Were this not possible persons living in the more remote parts of the archipelago would experience great difficulty in securing firewood and structural timber which they need.

The following licenses were granted during the fiscal year ending June 30, 1903: Timber, 938; firewood, 713; gums and resins, 98; dye-wood, etc., 53; charcoal, 43. Gratuitous licenses were issued as follows: To needy residents, 460; for cutting timber for public works, 122; firewood, 5. Total licenses, 2,432; total gratuitous licenses, 587.

Individual timber licenses are granted for 10,000 cubic feet, and company licenses for 100,000 cubic feet. Thirteen company licenses were granted during the fiscal year ending June 30, 1903. Under 6 of these no timber was cut, while under the others timber was cut as follows:

Company.	Cubic feet cut.	Company.	Cubic feet cut.
Danao Lumber Co.	847	Compañia Madera de Luzon	23,242
Mindoro Lumber Co.	7,615	Philippine Lumber and Commercial Co	31,264
Mindoro Commercial Co.	14,600	Chicote & Sanchez	1,915
Philippine Lumber and Development Co	106,869	Total	186,352

FEAR OF EXTENSIVE EXPLOITATION OF PHILIPPINE FORESTS BY LUMBER COMPANIES GROUNDLESS.

These figures clearly show how groundless were the apprehensions of those who feared ruinous exploitation of Philippine forests by great lumber companies. At present timber is growing much faster than it can be cut, and many of the forests would be greatly improved

by the systematic felling of the old trees which have reached maturity and will soon begin to decay if not converted into lumber.

SPECIAL PRIVILEGES GRANTED TO THE ARMY.

To facilitate the operations of the military authorities in the construction of roads, bridges, and army posts, and the securing of poles for repairing telegraph lines, I authorized the forestry bureau to grant permission to cut gratuitously such timbers of all groups as might be necessary for Government work carried on by army officers, the report of the timber used to be submitted by the officer in charge of the work, after cutting, to the chief of the forestry bureau, and local rangers only to be notified in advance of such wood as is to be cut; contractors supplying such wood to be regarded as agents of the officer in charge of the work, and such officer to be held responsible that the contractor cuts only such timber as he delivers to be used for the work specified.

WORK OF THE TIMBER-TESTING LABORATORY.

I have referred in previous reports to the necessity for a comprehensive series of tests to ascertain the properties of the different kinds of timber produced in the islands. It is unquestionably true that many valuable varieties of timber are without market value at the present time because their properties are unknown. In the timber-testing laboratory, which is well equipped, there have been made during the year 128 complete tests covering 80 different species of wood. At present only those woods are tested which have been determined botanically. A full explanation of the tests applied will be found in the appended report of the chief of the forestry bureau.

A number of the species of wood tested are worthy of special notice because of their excellence. Alupag-amo showed the remarkable strength of 15,110 pounds per square inch when subjected to the "compression endwise" test. The stress at elastic limit equaled 17,620 pounds per square inch, and strength at rupture equaled 19,700 pounds per square inch. Macapali, a wood from Mindanao, showed a specific gravity of 1.32 and a stress at elastic limit (equal to the stress at rupture) of 14,500 pounds per square inch.

The following table may be of interest as showing the relative strengths of some of the more important Philippine and American woods under the crushing endwise test. The figures from Philippine woods are the averages obtained from five or more tests; those given for United States woods are from United States Bureau of Forestry tests.

<i>Philippine woods.</i>		<i>American woods.</i>	
Alupag-amo.....	15, 110	Pignut hickory.....	10, 900
Betis.....	11, 270	Mockernut hickory.....	10, 100
Dungon.....	10, 570	Butternut hickory.....	9, 600
Molave.....	10, 460	Pecan hickory.....	9, 100
Dagat laya.....	10, 410	Cuban pine.....	9, 080
Calamansanay.....	10, 370	Longleaf pine.....	7, 930
Dilang bitiqui.....	9, 780	White oak.....	8, 500
Bitanhol.....	9, 670	Texan oak.....	8, 100
Ipil.....	9, 000	Water oak.....	7, 800
Tindalo.....	8, 800	White ash.....	7, 200
Bancoro.....	8, 430	Green ash.....	8, 000
Supa.....	7, 230		
Tucan calao.....	7, 170		

The chief of the forestry bureau estimates that there are between 1,000 and 1,500 tree species growing in the public forests of the Philippines, of which about 50 varieties make up 80 per cent of the timber entering the market. It is important to learn what of the remaining species are useful and for what purposes they can be used to good advantage. To this end, tests will be systematically carried out in the timber-testing laboratory.

WORKSHOP OF THE FORESTRY BUREAU.

In order to further test the properties of our unknown woods, a workshop has been established, where specimens can be thoroughly seasoned and worked up into such shape as to make them marketable.

The bureau has been fortunate in securing the services of Mr. T. J. Piffard, who is not only a cabinetmaker, but is also familiar with modern wood-working machinery and with the chemistry of stains. Shortly after his arrival in the Philippines a workshop 40 by 40 feet was erected near the timber-testing laboratory. The force in this shop at present consists of about 50 men, many of whom are skilled Filipino wood carvers, finishers, and carpenters. These workmen are being trained in American methods and are making good progress. The workshop is now well furnished with modern wood-working machinery.

The art of properly polishing woods is at present unknown in the Philippine Islands, and great difficulty has been experienced in purchasing the material needed for this purpose.

IDENTIFICATION OF WOODS BY MICROSCOPIC SECTIONS.

Much difficulty has heretofore been encountered in correctly naming even the more important Filipino woods when inspected in the log, but microscopic sections of woods superficially very similar show striking differences in structure. Methods of sectioning which have been successfully used in the United States have proved impracticable, owing to the great hardness of many of our woods, but difficulties have gradually been overcome, and we now have microphotographs of at least three sections—one perpendicular to the fiber, one parallel to the medullary rays, and one tangential—of each of 40 different wood species, including many of the most important. A valuable means of definitely determining wood species in the log is thus being provided.

BOTANICAL WORK.

The work of identifying our tree species is progressing steadily. Some 1,200 identifications have been made during the past year, of which 200 were based on leaf specimens only. Duplicates of material which could not be identified in Manila have been sent to specialists in Europe.

Data for a dictionary of the native plant names of the Philippines are at present being compiled. Such a work is greatly needed by the employees of the forestry bureau, owing to the complicated synonymy of the native names for trees. Of the 660 tree species enumerated in the order which fixes the government tariff on lumber cut on public lands, 302 have been collected and identified during the past year, the list of identified species including nearly all of those known to be of special importance.

INVESTIGATION OF DYEWOODS.

An employee of the bureau was detailed to investigate the dyewoods of the islands. He obtained more than 100 varieties, specimens of which were sent to the bureau of government laboratories for investigation as to their value. Specimens from the same collection will also be exhibited at the Louisiana Purchase Exposition.

WORK ON THE FOREST RESERVATION IN BATAAN.

A field party is now on the Lamao River, in the province of Bataan, preparing ground for a forest nursery and a future forest school and studying the tree species of the Lamao watershed, about 12,000 acres in extent, reaching from the sea level to an elevation of 4,500 feet above the sea. A systematic study of the 300 or more tree species found in this area has been inaugurated, typical trees being selected, labeled, and mapped, so that they can be readily identified in future. Tree seeds in considerable variety have been collected and germinated at Manila. The young plants will later be transferred to nurseries on the reservation. The first nursery site has been selected at an elevation of 500 feet above the sea. The forest school will be established on this site, from which a fairly good road has been constructed to the landing place. The second nursery will be at an elevation of 1,800 feet. Material for buildings is now being secured.

PRIVATE WOODLANDS.

The number of private woodland estates at present registered in the forestry bureau is 129, with an aggregate area of 106,647 hectares. The largest of these estates, situated in the provinces of Tarlac and Nueva Ecija, has an extent of 13,202 hectares.

AMOUNT OF FOREST PRODUCTS FROM PUBLIC LANDS IN 1902 AND 1903.

From the following comparative table of the quantities of forest products taken from the public lands of the Philippines during the fiscal years ending June 30, 1902, and June 30, 1903, it will be seen that there has been a small increase:

	1902.	1903.
	<i>Cubic feet.</i>	<i>Cubic feet.</i>
Timber.....	3,637,392	4,740,738
	<i>Cu. meters.</i>	<i>Cu. meters.</i>
Firewood.....	107,849	218,100
Charcoal.....	7,021	3,795
	<i>Pounds.</i>	<i>Pounds.</i>
Dyewoods (sapan).....	2,256,458	5,568,773
Tan bark (cascalote).....	312,154	900,963
Damar (gum copal).....	1,082,235	1,358,172
Gutta-percha.....	373,331	609,573
Rubber.....	282,996	1,293
Breas, resins, etc.....	113,905	752,280
	<i>Liters.</i>	<i>Liters.</i>
Oils Panao (wood oil).....	34,752	53,529
	<i>Pounds.</i>	<i>Pounds.</i>
Rattan.....	20,685	230,758

Gratuitous licenses, 1903.

Timber	cubic feet...	153, 029
Firewood	cubic meters...	1, 125

From private estates, 1903.

Timber	cubic feet...	353, 759
Firewood	cubic meters...	51, 270
Charcoal	do.....	9, 304

IMPORTS AND EXPORTS OF FOREST PRODUCTS.

There were imported into the Philippine Islands during the fiscal year ending June 30, 1903, 113,483 cubic feet of timber on commercial liners; 6,841,207 board feet, free entry for Government use, and 4,746 tons of timber, free entry for Government use. There were exported 87,000 feet, board measure.

EXPENSES OF FORESTRY BUREAU.

During the fiscal year ending June 30, 1902, the expense of conducting the forestry bureau was \$61,967.25, United States currency, and the revenue collected amounted to \$348,073.08 Mexican. During the fiscal year ending June 30, 1903, the operating expenses amounted to \$96,202.36, United States currency, and the revenue collected to \$527,414.85 Mexican.

We may look forward with confidence to a steady increase in the revenues derived from forest products, and at the same time to actual improvement in the forest areas where active lumbering operations are carried on.

For further information with reference to the work of the forestry bureau, and for the recommendations of Mr. Gifford Pinchot, Chief of the Forestry Bureau of the United States, reference is made to the second annual report of the chief of the forestry bureau, which is appended hereto and marked Appendix E.

THE MINING BUREAU.

During the past year the work of getting the Spanish mining records so arranged and indexed as to make them thoroughly accessible has been practically completed. This difficult undertaking has been carried out in a way which reflects the greatest credit on the chief of the mining bureau and his associates. The records, which were originally in seemingly hopeless confusion, have been made so accessible that any desired document can be found immediately.

The chief of the mining bureau, who was absent on leave at the time of my last annual report, did not return to Manila until January 26, 1903, while Mr. McCaskey, the assistant chief, left on leave of absence on May 1, 1903, and has not yet returned. The bureau has, therefore, been short-handed throughout the greater part of the year.

Bulletin No. 3, entitled "Report on a Geological Reconnaissance of the Iron Region of Angat, Bulacan," has gone through the press and has been distributed. It contains a large amount of practical information of value to prospective miners or investors, and it is hoped that its publication may stimulate the development of the important

deposits of iron ore at Angat, especially as the assistant chief of the bureau has now demonstrated that there are several coals produced in the Philippine Islands which will coke.

REORGANIZATION OF THE MINING BUREAU TO FACILITATE FIELD WORK RECOMMENDED.

In view of the fact that the records of the mining bureau are now in satisfactory condition, and that the administrative work with reference to titles to mining claims has been transferred to the bureau of public lands, both the chief and the assistant chief of the mining bureau strongly recommend that the bureau be reorganized in such a way as to permit of its effectively carrying out reconnoissances of the important mineral regions of the Philippines, in order that accurate information of value to the prospector, the miner, and the capitalist may be made available and the development of the mining industry may be stimulated. I heartily concur with these gentlemen as to the wisdom of the proposed reorganization.

ACTIVE MINING OPERATIONS BEGUN.

With order reestablished throughout the archipelago active mining operations have been begun at several different points with good hope of success. Promising coal mines are being developed on the island of Bataan, both by private capital and by the United States Government. Active work has also been done on the gold deposits of Mambulao and Paracale, in Ambos Camarines, and upon several gold-mining claims in the province of Benguet. The mining bureau has stimulated much of this work by investigations and reports which showed that it might be undertaken with good hope of substantial pecuniary returns. There is every indication that we are entering upon an era of active development of the mineral resources of the archipelago, which should bring prosperity to a number of regions the inhabitants of which are at present poor and obtain a livelihood with comparative difficulty.

It is gratifying to note the statement in the report of the chief of the mining bureau that in spite of the fact that the number of prospectors has greatly diminished during the past year new discoveries and locations have been more numerous than in any previous year, and the amount of development work done has also been much larger.

MINERALOGICAL MAP OF THE PHILIPPINES.

The mining bureau has completed a map of the archipelago, showing the mines and mineral deposits of proven value. It should be of assistance to all persons interested in the mineral wealth of the Philippines.

RECOMMENDATIONS OF CHIEF OF MINING BUREAU.

Among the recommendations with which the chief of the mining bureau closes his report is one that the present mining law be so amended as to enable more than one claim to be located by the same individual or association of individuals upon a lode or deposit. I very heartily indorse this recommendation.

As development progresses it becomes more and more evident that a number of the more valuable gold deposits of the Philippines will prove to be of low grade. Their development will involve the use of expensive plants, and if the necessary capital is to be secured it must be possible to obtain title to larger tracts than can be located as single claims under the present law.

The chief of the bureau also recommends that authority be given for the free use of timber required in mining, subject to reasonable regulations and restrictions to prevent waste. I am unable to see why there is any more reason for granting free use of timber required in mining than for making a similar grant in the case of timber required for railroad or house construction, and disapprove this recommendation.

FIELD TRIPS.

The assistant chief of the bureau, having acted for the chief of the bureau during the absence of the latter official, has rendered a separate report for the period of his incumbency. In addition to carrying on the extensive correspondence which resulted from the taking effect of the act of Congress of July 1, 1902, the assistant chief performed his regular duties as mining engineer and conducted field trips to the Calamianes, Cuyos, and Paragua groups of islands and to the coral island of Apo, west of Mindoro, during which there was secured a considerable amount of interesting information relative to the geology of these little-known regions, which has been embodied in a report.

ADDITIONS TO COLLECTIONS.

Substantial additions have been made to the geological and mineralogical collections of the bureau during the past year. The present building does not afford adequate facilities for storing these collections, much less for exhibiting them. I am of the opinion that a wing should in the near future be added to the new building of the bureau of government laboratories sufficient in size to afford adequate accommodations for the mining bureau and the forestry bureau. I have requested the insular architect to prepare plans for, and estimate the cost of, such an addition to this building.

PLAN FOR EXHIBIT AT THE LOUISIANA PURCHASE EXPOSITION.

The assistant chief of the bureau has prepared plans for a mineral exhibit at the Louisiana Purchase Exposition. These plans have been adopted by the exposition board, and, so far as practicable, have been carried out by collectors employed by that body.

For further information relative to the work of the mining bureau during the past year, reference is made to the annual report of the chief of the bureau (Appendix F) and to the report of the assistant chief of the bureau which accompanies it.

BUREAU OF GOVERNMENT LABORATORIES.

The Government has been fortunate in retaining throughout the year the services of Dr. Paul C. Freer, superintendent of government laboratories, under whose able administration the bureau has been

brought to a high degree of efficiency and usefulness. Further extension of leave was at first refused him by the authorities of the University of Michigan, but upon the request of the Secretary of War was finally granted. He has continued wisely to direct the somewhat complicated affairs of his bureau and to render valuable service as a member of the insular board of health. Permission was granted him to return to the United States in order to secure employees for the bureau and attend to private affairs, but at the last moment an emergency arose in connection with the purchase of cattle for the Government at Shanghai, and he was sent there to investigate and report.

The Commission has shown its appreciation of his services in a substantial way by increasing his salary to \$6,000.

OPENING OF LABORATORIES TO THE PUBLIC.

The bureau of government laboratories has rendered very important service not only to the insular government but to the public at large during the past year. While the law under which this bureau was organized provided that all biological and chemical work for the insular government should be performed by it, there was originally no thought of its doing work for private persons, nor was there any provision of law under which such work could be done.

It eventually became evident, however, that it was desirable to place many of the facilities afforded by the bureau at the disposal of the general public. There was no other place where adequate means existed for making diagnoses which involved the use of high-power microscopes or necessitated pathological investigations, nor where chemical work of the simplest sort, other than mineral assays, could be performed. Moreover, many of the assays made by private persons proved so unreliable as to suggest deliberate intention to deceive on the part of those who made them. It was felt that the development of the mineral resources of the islands would be stimulated if it were possible for miners, prospectors, and other interested persons to secure reliable government assays, and that no harm could come from placing the facilities for chemical and pathological work, which the laboratories afforded, at the disposal of the general public. Legislation was accordingly adopted authorizing the superintendent of government laboratories to prepare, subject to my approval, a list of fees to be charged for different kinds of work. The list was prepared and published, and a steadily increasing amount of work for private persons is now being done.

The policy which has been inaugurated, with reference to the chemical and biological laboratories, has not yet been extended to the serum laboratory; in fact, it has not yet been feasible to so extend it, as the products of this laboratory have been required by the government as rapidly as they could be produced. When the plant at present contemplated has been established and manufacture is well under way, a slight additional cost will enable the laboratory to supply serums and prophylactics to outside persons, thereby making it possible for them to obtain products of great value which they are now wholly unable to secure. A revenue sufficient to support the serum laboratory might ultimately be derived from this source. A small beginning has already been made by the authorization of the sale of antirinderpestic serum to private persons in Shanghai. I am of the opinion that, in the

interest of the public and the laboratory as well, this policy should be continued and extended to other products of the laboratory as the supply may from time to time warrant.

BUILDINGS.

The new building for the bureau, for which an excellent site was secured on the exposition grounds, is approaching completion and should be ready for occupancy about July 1, 1904. Meanwhile the rapidly increasing work of the bureau has necessitated the renting and equipment of a large dwelling house, where the biological work is now performed and the library stored. The original building is now entirely given up to chemical work.

THE SERUM LABORATORY.

The most important change in the bureau during the year was the transfer to it on January 30, 1903, of the serum laboratory of the board of health, the incorporation of the former vaccine institute with the serum laboratory, and the appointment of Dr. James W. Jobling as director of the new laboratory thus established. Doctor Jobling, with his customary energy, at once began to push the work of obtaining a herd of serum animals free from all disease. He quarantined all new animals admitted to the laboratory, improved the vaccine virus by a fresh importation from Japan, and obtained a regular and sufficient supply of small animals for purposes of experimentation. Under his able management the foot-and-mouth disease, which has been a source of endless annoyance in connection with the serum work, disappeared. Systematic care and proper feeding of cattle produced conspicuous improvement in their condition, and since the 1st of February there has never been any lack of excellent vaccine virus and rinderpest serum. The herd of immune cattle has been increased to about 80 animals, and new animals are added as opportunity offers. Nine hundred thousand doses of vaccine virus have been prepared during the past six months, and some 4,000 cubic centimeters of Shiga prophylactic serum for use in immunizing against bubonic plague have been prepared and delivered to the insular board of health.

The work of preparing antiseptic serum, the need of which has long been recognized, has also been inaugurated, and the laboratory now has on hand 5 horses which are rapidly being brought to a point where they will yield a serum of good efficiency. Eight hundred cubic centimeters have already been prepared.

The work of the serum laboratory has been carried on in the face of very serious practical difficulties, which it would be tedious to enumerate. Great credit is due to Doctor Jobling and his subordinates for the unvarying success with which obstacles have been overcome.

The work of caring for animals imported by the government while at Manila prior to distribution, which was taken from the bureau of agriculture and given to the serum laboratory, has been very satisfactorily performed by laboratory employees.

The work of inoculating cattle in the provinces against rinderpest, wherever the disease has appeared, has been considered of the first importance, and every available man has been made use of for this

purpose, including, as previously stated, employees of the serum laboratory, of the insular board of health, and of the bureau of agriculture.

The scientific force of the serum laboratory has been insufficient for carrying on so large a volume of work, especially in view of the fact that Dr. John G. Slee, a skilled veterinarian in the employ of the insular board of health, who had been practically detailed to the serum laboratory, was of necessity sent to Shanghai to meet an emergency which arose there in connection with the purchase of carabaos for the insular government, and has remained there on duty.

The carrying on of systematic investigations would still further increase the efficiency of the laboratory and decrease the cost of manufacturing its products. Thus far the energies of its employees have of necessity been almost exclusively directed to routine work, but a materially increased force has been authorized. When the newly created positions have been filled, the routine work can be carried on to much better advantage than at present, and opportunity will also be afforded for the carrying on of much-needed research.

The transfer of the serum laboratory to the bureau of government laboratories and the incorporation with it of the vaccine institute has resulted in economy of administration and improvement in the products manufactured, notably in the case of vaccine virus. The laboratory has been extraordinarily successful in the manufacture and use of antirinderpestic serum, securing, by the simultaneous inoculation method, almost complete immunity against rinderpest and losing a very low percentage of the animals inoculated. It is doubtful whether so great success in immunizing against rinderpest has ever been obtained elsewhere, and the manufacture of the necessary serum has made it possible for the government to take up vigorously the work of immunizing all horned cattle remaining in the islands and all that are imported, and to inaugurate upon a large scale the restocking of the islands with carabao. As the rehabilitation of agriculture is absolutely dependent upon the provision of an adequate supply of draft animals, the importance of this result will be readily appreciated.

The facilities on the San Lazaro grounds for the proper care of serum animals and of other valuable animals during inoculation have been greatly improved and increased, but all changes there are necessarily of a temporary nature, in view of the fact that the insular board of health will ultimately need all of the ground at present occupied by the serum laboratory for contagious-disease hospitals. The distance of the San Lazaro estate from the site of the new laboratory building is, in any event, such as to necessitate the transfer of the serum work to some other conveniently situated place at the time the new laboratory building is occupied. A suitable site has been secured from the municipal board of Manila in the district of Paco. When the new building is ready for occupancy the serum work will be transferred to it and to this plot of ground. Vaccine work, and all of the work connected with the preparation of serums involving the use of horses or small animals only, will be conducted at the main laboratory building, and, in fact, serum of every sort will be prepared, packed, and shipped there, but the stalls for immune animals from which antirinderpestic serum is made, the operating room for bleeding them, a barn for feed and supplies, and a building for the watchman, which will also afford suitable facilities for caring for fresh blood, will be established on the Paco site.

LIBRARY.

The working library has been considerably increased during the past year. A list of the more important publications which are, or soon will be, on hand is contained in the annual report of the superintendent of government laboratories. There is great need of additional literature covering the field of industrial chemistry, especially in view of the fact that the chemical laboratory has been opened to the public. Adequate literature on veterinary medicine and surgery is also imperatively needed, veterinary work having sprung into great prominence on account of the large importations of cattle by the government and the necessity for caring for animals injured on the voyage, and for safeguarding the islands against the introduction of new cattle diseases by the animals imported. Hemorrhagic septicæmia has already been introduced from Hongkong, as previously stated. Fortunately the disease was promptly recognized, and precautions were taken which proved effective in preventing its spread. Its occurrence serves to emphasize the importance of having on hand necessary literature so that other new diseases may be dealt with as promptly and effectively.

NEW APPARATUS AND SUPPLIES.

Additional apparatus and supplies have been received as rapidly as they could be installed or used. Some large apparatus, including a vacuum distilling plant, extractors, and other appliances intended for use in working up essential oils, rubber, gutta-percha, etc., can not be installed until the new building is available, and the ordering of them has therefore been delayed.

ASSAY WORK.

The assay work of the bureau has necessarily thus far been done in the building of the mining bureau with rather insufficieet facilities, but an adequate outfit has been ordered and will arrive quite as soon as space for its installation is available.

GAS SUPPLY.

The machine for furnishing a supply of gas by the destructive distillation of cocoanut oil in a red-hot iron retort has worked so satisfactorily that the same kind of apparatus, with a larger tank capacity, will be used for supplying gas to the new building.

CHARACTER OF CHEMICAL WORK DONE.

The chemical work during the year has involved analyses of suspected counterfeit silver coins; examinations for poison, some of which were made for chemical-legal purposes; investigations of suspected blood stains in murder cases; analyses of mineral and other waters, soils, coals, paints, and alloys. A large amount of assay and analytical work has been done for the exposition board in connection with exhibits to be made at the Louisiana Purchase Exposition. The number of analyses made is more than double that of last year.

Dr. P. L. Sherman was sent on a second expedition to the southern islands to gather material for completing his work on rubber and gutta-percha, and has also made some explorations in the island of Mindoro, which resulted in the discovery of rubber, apparently of superior quality. A complete bulletin on the subject of rubber and gutta-percha in the Philippines will be issued in time for use at the Louisiana Purchase Exposition.

The superintendent of government laboratories, with Doctor Sherman and others, made a trip to Paragua, hoping to find there *Dichopsis gutta*, from which the best gutta-percha is produced. A thorough exploration was made, but neither gutta-percha trees nor rubber vines were found. Gum dammar was, however, found in abundance, and a considerable quantity brought to Manila for study and for exhibition purposes.

Systematic work upon gums and resins will be continued, and promises important results.

A large amount of work has already been done by Mr. Bliss on the so-called "brea," which, it proves, comes from a number of different trees, and from which various essential oils have already been derived.

Two samples of surface mineral oils have been brought to the laboratory, one of which proved to be of such a nature as to warrant recommendation for further investigation and development.

THE BIOLOGICAL LABORATORY.

DIAGNOSTIC WORK.

The diagnostic work performed in the biological laboratory has also steadily increased. Some 7,000 diagnoses have been made during the past six months, and, in addition, thousands of rats and mice have been examined for plague. Four medical-legal cases have been handled, 500 tissues have been prepared for microscopic examination, and a large number of post-mortems have been held. As in the chemical and serum laboratories, time which should have been available for important research work has been greatly encroached upon by the very large amount of routine work necessarily performed, so that important investigations have been delayed or postponed. It is hoped that this difficulty may be met here, as in the other laboratories, in the near future through the augmentation of the working force, for which provision has been made.

ORIGINAL INVESTIGATION.

In spite of the pressure of routine work, Doctor Musgrave, assisted by Messrs. Clegg and Williamson, has carried out an important piece of investigation on surra. His results, which have in part been published in a preliminary bulletin, appear in the appended report of the superintendent of government laboratories. They provide us with adequate information on which to base a quarantine law to prevent the introduction of further cases of this disease, and make plain the measures to which we must resort in order to destroy the widespread infection which now exists. The loss of horses from surra has already been enormous, and energetic measures for its repression should at once be inaugurated along the lines suggested by Doctor Musgrave.

ACTING DIRECTOR APPOINTED.

Doctor Musgrave served as acting director of the biological laboratory from December 15, 1902, to July 15, 1903, during the absence of the director, and very efficiently performed the duties of this office. The director, Doctor Strong, was granted a special leave of absence by the Commission in order to go to Europe for study. He visited the London School of Tropical Medicine; the German School of Tropical Medicine, at Hamburg; the Pasteur Institute, at Paris, and the government civil hospitals at Port Said and Colombo, Ceylon, paying especial attention to recent advances in laboratory methods, technique, and apparatus, and obtaining information with reference to improved methods of dealing with tropical diseases.

At Berlin, having obtained admission to the Königl. Institut für Infektionskrankheiten, he took up special work in immunity in the department of Professor Wassermann, and as a result produced what he believes to be a practicable cholera vaccine. Opportunity has not yet presented itself to give this vaccine a practical test in the Philippines.

ENTOMOLOGICAL WORK BEGUN.

Entomological work has been begun in the biological laboratory by Mr. Charles S. Banks, who was appointed entomologist on December 9, 1902. Mr. Banks's attention has been directed to the insects which destroy or interfere with the growth of the cacao bush. His work, which was begun in the island of Negros, has since been prosecuted in a number of other regions. He has attempted to gather all data on insects affecting the roots, trunk, leaves, flowers, and fruit of cacao bushes, and has secured extensive collections of such predatory insects and samples of their work. His results, which are briefly set forth in Appendix G, will soon be published in a bulletin which it is hoped will be of much practical value to cacao growers.

Subsequently to the appointment of Mr. Banks as entomologist, Mr. J. L. Webb was appointed assistant entomologist, and is now engaged in investigations with especial reference to insects harmful to forest growth and to cut timber.

BOTANICAL WORK.

The botanical work of the government has been transferred to the bureau of government laboratories and a considerable increase in the force of botanical workers has been authorized, including an additional systematic botanist and two field collectors. Satisfactory progress is being made in the study and identification of our tree species and of plants of economic value, but the amount of botanical work which needs to be done is enormous, and with any possible force of workers can not be completed for many years.

SECTIONING WOODS.

Very interesting and important work has been done in the biological laboratory by Mr. J. J. Eaton of the bureau of public instruction, who was engaged as a temporary employee during his vacation to prepare microscopic sections of different woods for the forestry bureau.

Much difficulty was experienced in softening our harder woods so that they could be successfully cut on the microtome, but this was eventually overcome and very satisfactory results were ultimately attained, which will be of great importance to the forestry bureau as affording a means of conclusively identifying timber samples.

MARINE BIOLOGICAL LABORATORY RECOMMENDED.

The superintendent of government laboratories in his report recommends the establishment in the near future of a marine biological laboratory for investigating the marine life, which affords so large a part of the food supply of the islands. Act No. 222, providing for the organization of the executive departments, included among the bureaus of the department of the interior a bureau of fisheries, which was designed to inaugurate and carry on this special line of work. The title used to designate the administrative body charged with this undertaking is a matter of comparatively small importance. While they will involve extensive field operations, they will also involve the employment of laboratory facilities, apparatus, and workers. I am of the opinion that the argument of the superintendent of government laboratories in favor of the establishment of a marine biological laboratory is sound, and that economy and efficiency will be gained by affiliating it with the bureau of government laboratories, as has already been done with the serum laboratory.

The director of such a laboratory might well be made available for appointment as superintendent of government laboratories, and the list of possible candidates for this position thereby increased. This would be a distinct advantage, for this position necessitates not only a high degree of technical proficiency, since its incumbent must be a director of one of the laboratories constituting the bureau, but a high degree of administrative ability as well, and carries with it membership on the board of health for the Philippine Islands. It may well happen that the director of a laboratory is capable of supervising very efficiently the work in his special line, but that he lacks the executive ability necessary to the successful management of the interests intrusted to the bureau of government laboratories as a whole, or that he has both of these qualifications but is without those which would especially fit him for membership on the board of health. Briefly, this position will always be a difficult one to fill, and in filling it it would be better to have four men to choose from than three.

I am decidedly of the opinion that the work of investigating those marine organisms which afford food or furnish articles of commerce should now be inaugurated and pushed, in order that our fisheries may be systematically and wisely developed, and that a satisfactory basis may be afforded for necessary protective legislation. The exhaustion of the Ceylon pearl fisheries should teach us a lesson.

THE GOVERNMENT PHOTOGRAPHER.

During the past year the government photographer has been provided with two assistants and furnished with greatly improved equipment. He has made a large series of valuable negatives which afford a permanent photographic record of conditions at present prevailing among many of the non-Christian tribes of the archipelago and of

their manners and customs. He has also performed a large amount of work for the forestry bureau, the bureau of agriculture, and the custom-house.

WORKING FORCE.

Although the working force of the chemical laboratory, the biological laboratory, and the serum laboratory have been materially increased during the present year, the work has increased more rapidly than have the workers. Much difficulty has been encountered in securing, on short notice, suitable candidates for newly created positions. This has been due in part to ignorance in the United States as to the work of this bureau and the facilities available for carrying it on, and in part to an increased demand for chemists, pathologists, and serum men in connection with industrial chemical work and city health work in the United States. I have taken advantage of the opportunity afforded by my return to the United States on leave to visit the University of California, Leland Stanford University, the University of Chicago, the University of Michigan, Harvard University, the Massachusetts Institute of Technology, Columbia University, the University of Pennsylvania, Johns Hopkins University, and Cornell University, and in conference with professors of chemistry, pathology, veterinary medicine and surgery, and botany, to inform them as to the nature of the work which we are doing and the facilities for it which are, or soon will be, available, and to arrange with them for securing a waiting list of candidates for positions hereafter created. It is therefore hoped that the laboratories may not be so short-handed in the future as they have been in the past.

I found everywhere the keenest interest among scientific men in the work of this bureau, and was gratified to learn that when the new building is completed and properly equipped a number of well-known American investigators will be glad to avail themselves of the facilities thus afforded for carrying on research work.

The superintendent of government laboratories in his annual report calls attention to the fact that in order to obtain suitably collected material in sufficient quantity it has been necessary to employ skilled employees of the chemical laboratory in the field. This difficulty can readily be met by utilizing a very different and less expensive class of men as collectors.

REORGANIZATION OF THE BUREAU NEEDED.

Recent experience in the matter of promptly securing employees of this bureau to meet the demands caused by a rapidly increasing volume of work or by the arising of special emergencies has been such as to make plain the necessity for having constantly available an adequate force of employees, and of knowing as long as possible in advance what new positions are to be created, so that a waiting list of candidates for them may be secured. There is need of change in the clerical force of the bureau in the interest of good administration. The powers and duties of the superintendent should be in some particulars more clearly defined. In short, there has arisen the same necessity for reorganization which has manifested itself in connection with many other bureaus of the insular government which have developed rapidly. A draft of an act providing for such reorganization has been

prepared and submitted to the Commission, and I trust that action may be taken upon it in the near future. In it provision has been made for the accommodation of scientific guests who may wish to visit the Philippine Islands for the purpose of carrying on research work. It is important that the facilities of the laboratories should be made available for such men. This could be done at slight expense, not at all commensurate with the resulting advantages.

For further details relative to the work of the bureau of government laboratories, reference is made to the report of the superintendent of government laboratories, which is appended hereto and marked Appendix G.

THE BUREAU OF PUBLIC LANDS.

The chief of the bureau of public lands reports that frequent inquiries have been made of him during the past year as to the area of the public domain of the Philippine Islands. He states that accurate information on this subject can not be furnished at the present time, because of the lack of a proper system of surveys and of trustworthy data as to Spanish land titles. He, however, roughly estimates the public domain at 61 million acres, of which some 40 million acres are forest land and the remaining 21 million acres are lands not forested, most of which are agricultural in character and will be subject to disposal under the law permitting leasing, sale, and homesteading as soon as the regulations prepared by the Philippine Commission under the law shall have become effective, either through their approval by Congress or through the failure of Congress to act upon them.

LEGISLATION DRAFTED BY THE CHIEF OF THE BUREAU.

At my request the chief of the bureau of public lands drafted rules and regulations relative to the location of mining claims in September, 1902. The draft prepared by him was submitted to a number of practical miners, and certain changes which were suggested by them and approved by him were incorporated. These regulations were then embodied in act No. 624 of the Commission, which was passed on February 7, 1903. This act, as amended by act No. 777 and act No. 859, together with the act of Congress of July 1, 1902, constitutes the existing law with reference to the acquiring of titles to mines on the public domain of the Philippine Islands.

Under these acts there have been presented for record 357 lode claims, 95 placer claims, 6 coal claims, and 141 claims the character of which was not designated, making a total of 599. The distribution of these claims by provinces is as follows: Benguet, 285; Lepanto-Bontoc, 106; Masbate, 60; Surigao, 31; Cebu, 26; Nueva Ecija, 17; Bulacan, 16; Pangasinan, 16; Ambos Camarines, 15; Tayabas, 10; Antique, 5; Mindoro, 4; Abra, 2; Laguna, 2; Bataan, 1; Ilocos Sur, 1; Misamis, 1; Rizal, 1.

The rules and regulations relative to the disposition of public lands required to be prepared by the government of the Philippine Islands by section 13 of the act of Congress of July 1, 1902, were also drafted and embodied in an act by the chief of the bureau of public lands. This act has been carefully considered and somewhat modified by the Commission, and in its modified form will be submitted for public discussion at Manila before its passage by the Commission.

The acts prepared for the Commission by the chief of the bureau of public lands have been very carefully drafted by him after much laborious investigation, and have been of great assistance to the Commission in dealing with the important matters of which they treat.

PLAN FOR GOVERNMENT SURVEYS.

The important work of preparing and recommending to the Commission for adoption a plan for a system of surveys for the islands has been referred to a committee consisting of the chief of the bureau of public lands, an associate judge of the court of land registration, the chief of the coast and geodetic survey of the Philippines, the chief of the mining bureau, and the consulting engineer to the Commission.

SPANISH LAND TITLES.

The work of preparing expedientes relative to Spanish land titles has progressed somewhat slowly during the year, owing to the additional burden imposed upon clerks of the bureau by the necessity of searching for and making certified copies of documents desired by private persons and by other bureaus of the government, and more especially to the death of Mr. Gregorio Basa, chief clerk of the bureau. Mr. Basa was a Filipino who had a very accurate and intimate knowledge of Spanish legislation relative to public lands in the Philippines, and his death is a very serious loss to the bureau.

DRAFT OF INSTRUCTIONS TO DEPUTY MINERAL SURVEYORS.

The chief of the bureau prepared a map of the proposed town for lepers on the island of Culion, and a draft of a manual of instructions to deputy mineral surveyors. He also examined and found incorrect and returned to the company several times a description and plat of the right of way required by the Manila and Dagupan Railway Company for a branch line to Camp Stotsenberg.

ADMINISTRATION OF SAN LAZARO ESTATE.

On December 1, 1902, the chief of the bureau of public lands was appointed administrator of the San Lazaro estate, which formerly belonged to the Spanish Government and became the property of the United States by virtue of the transfer of sovereignty under the treaty of Paris. This estate is the owner of a number of properties in Manila, the proceeds from the rentals of which have been devoted to the maintenance of the San Lazaro Hospital for lepers. The most important of these properties is the Hacienda de Mayhaligue, situated in the northern part of the Santa Cruz district, which includes some 400 acres.

The chief of the bureau of public lands found that the rented portion of this property consisted of about 700 lots in the hands of some 460 tenants, of which number some 400 were subletting their holdings to other tenants in violation of the terms of their agreement with the insular government, and were making in this way a profit of 150 to 200 per cent, while they were paying to the government an amount equal to about $1\frac{1}{2}$ per cent of the assessed value of the estate, so that the government was losing thousands of dollars from rentals paid by

sublessees to its tenants who had no right to receive them. He estimated that by renting directly to the sublessees at twice the rate which the government had previously received for the several lots, the government revenue would be doubled, while at least 90 per cent of the actual occupants of the lots would pay less than they had been previously paying.

On January 1, 1903, he accordingly posted notices requiring all persons owning houses on the estate to pay their land rents directly to the administrator and prohibiting the subletting of lots except in case of lots containing buildings owned by the lessors. Vigorous protests against this action were made by persons who had been subletting their holdings in violation of their agreements, but the chief of the bureau was sustained in his action by the civil governor.

The system of subletting above referred to had resulted in subdividing the blocks of the estate into a large number of irregular lots, which were without systematic arrangement, and many of which did not front upon any street, so that they could be reached only by passing over lots occupied by other persons, and disputes as to right of way naturally arose with frequency.

The chief of the bureau, therefore, set about the preparation of a system of blocks and lots which would give to each tenant a frontage on some street or an outlet to a street through an alleyway, and as a preliminary step caused to be made an accurate survey of the exterior lines of the blocks situated south of the San Lazaro Hospital and of the boundaries of the whole property. At the same time an inspection was made of each lot, the name of the occupant was ascertained, and a new rental roll was made up.

Meanwhile a careful study of the property was undertaken, with a view to the planning of a system of streets which should not only accomplish the ends above mentioned in the thickly settled portion of the estate but should extend over that portion which is as yet largely unsettled and without streets.

Before the details of the proposed system could be worked out the thickly settled portion of the estate was devastated by the great Trozo fire, which destroyed practically every building within an area of 57 acres and rendered 7,500 of the people living on the estate homeless. Lines of demarkation between the several lots in the burnt district were obliterated, and work which had occupied employees of the bureau of public lands for months was completely wiped out. A plan of streets, blocks, and lots was, however, eventually prepared and submitted to the Commission, but that body finally decided in favor of another plan proposed by the city engineer of Manila.

The chief of the bureau of public lands has caused proceedings to be brought against various persons to whom former administrators of the estate had made leases for a period of ten years, in violation of a provision of the civil code which prohibited an administrator from making a lease for a longer period than six years without special authority. These lessees were given opportunity to rerent the properties at a rate in accordance with the uniform system which had been established, and on their failure to do so their contracts were canceled and proceedings were instituted to recover back rent and to eject them from the premises. Should the government win these suits, it is believed that the moral effect will be good on other tenants who have resorted to questionable means to avoid the payment of their rents.

The chief of the bureau of public lands calls attention in his report to an arrangement most disadvantageous to the government, by which parcels of land in the walled city of Manila and elsewhere belonging to the estate are held under contracts known in Spanish law as "censos enfitéuticos." He shows that in one instance the lessee is under obligation to pay to the estate a ground rent of 38.37 pesos per year for property which he is renting for 3,000 pesos per annum, and that the aggregate amount of rentals paid to the estate on property held under these "censos" in the walled city, the assessed value of which amounts to \$30,946.60, United States currency, is 224.36 pesos, or about \$100 United States currency. He very properly suggests that the validity of these "censos" be inquired into; that they be set aside if this can legally be done; and that the owners of the buildings be compelled to pay a reasonable rental for the lots on which they stand.

The chief of the bureau of public lands calls attention to the heavy burden imposed upon him and upon the working force of his office by the administration of the San Lazaro estate, and asks to be relieved of this responsibility for the reason that he can not properly discharge more important duties if he gives to the management of the estate the time which it requires. While commending him very heartily for the energy and efficiency which he has displayed in unraveling the tangled affairs of the estate and in safeguarding the interests of the Government, I am of the opinion that the regular employees of this bureau should not be burdened with this matter, and that if the administration of the estate remains in the bureau it should be carried on by subordinate employees especially appointed for this purpose.

CONGRESSIONAL LEGISLATION NEEDED.

The chief of the bureau of public lands calls attention to the fact that there is no method by which an alien while residing in the Philippine Islands may become a naturalized citizen of the United States or of the Philippines, and that an alien who has taken out his first papers as a naturalized citizen of the United States can not complete his naturalization here, so that men of foreign birth who have enlisted in the United States Army after years of residence in the United States, and who, after faithful service and honorable discharge, have located mining claims here have eventually found that they could not make legal locations of mining claims under existing law. A manifest injustice results, and it would seem that this matter might with propriety be submitted to Congress for remedial legislation.

He also calls attention to the fact that a double standard of measurement for mining claims has been prescribed in the act of Congress of July 1, 1902. It appears from an examination of sections 22, 23, 24, 25, 31, and 39 of this act that the intention of Congress is that lode claims be measured by feet and their contents computed in acres, while sections 43, 44, and 48 of the same act show that placer claims are to be computed in hectares. Sections 13, 14, 15, 18, 43, 48, and 53 indicate that it was the intention of Congress to apply the metric system to the surveying of the public domain and to the location of coal lands thereon. It is respectfully suggested that such a double system would be highly undesirable and that it was probably not the intention of Congress to prescribe it. Certainly all kinds of claims should be surveyed by one standard of measurement. The advantages of the metric

system are too well known to require enumeration, and I recommend that the attention of Congress be invited to this apparent oversight to the end that the use of the metric system in surveying all kinds of mining claims may be legalized.

The chief of the bureau also invites attention to practical difficulties which arose as a result of the provision "that the 'location line' shall govern the direction of one side of the claim, upon which the survey shall be extended according to this act." It is the apparent object of this section to provide that claims shall have their side lines parallel to the location line and shall be of a rectangular form, but section 22 permits a departure from this form in cases where the boundary line of a previously surveyed claim is adopted as common to both claims.

The chief of the bureau shows, by means of a diagram and full explanation, the difficulties which may arise under the provision above quoted, and suggests that it be amended so as to read: "That the side lines of the claim shall be parallel to and the end lines perpendicular to the location line, excepting such portions of the said side lines or end lines as may be formed by adopting the boundaries of previously surveyed claims." He recommends that the above amendment be submitted to Congress, and I concur in this recommendation.

The chief of the bureau also calls attention to the fact that sections 28 and 29 of the act of Congress of July 1, 1902, and sections 12 and 13 of act No. 624 of the Philippine Commission refer to certain circumstances under which mining claims shall not be recorded. He suggests that while the law appears to be very plain as to what these circumstances are, the fact remains that most of the provincial secretaries are not persons of sufficient knowledge or experience to justify placing in their hands discretionary powers in a matter of this kind. It is his opinion that it would be wise for Congress and the Commission so to amend the existing law that nothing shall be allowed to prevent the recording of a mining claim; leaving the requirements of the law as they are, but permitting no one to say whether these requirements have been complied with until the claim reaches the point where an application is made for an official survey with a view to obtaining title. This is the practice in the United States. It results in throwing the responsibility for error on the locator of the claim, and it prevents the improper exercise of authority on the part of the recorder. I am of the opinion that the law might well be amended in this regard as suggested.

I desire to especially commend the untiring energy and the high degree of efficiency which the chief of the bureau of public lands has displayed in the discharge of his duties.

For further details as to the work of the bureau of public lands during the past year, especially as to its operations in connection with the San Lazaro estate, and for a full statement of the reasons for the suggested amendments to the act of Congress of July 1, 1902, reference is made to the annual report of the chief of the bureau, which is appended hereto and marked Appendix H.

THE BUREAU OF AGRICULTURE.

The work of the bureau of agriculture during the past year has been highly satisfactory so far as the preparation and publication of bulletins embodying information likely to be of value to agriculturists is con-

cerned. So far as concerns the establishment and operation of experiment farms, the stock farm, the school of agriculture, and the handling of draft animals imported by the insular government, it has in many particulars been highly unsatisfactory.

The issuing of bulletins containing reliable information with reference to proper culture methods for the growing of crops already raised in the islands and to the introduction of crops not heretofore grown, or with reference to the soils of the several provinces, showing what crops may be grown in given areas to the best advantage, is undoubtedly a matter of great importance to the prospective foreign or American investor in agricultural lands and to the more highly educated Filipinos, who will be likely to read such bulletins and profit by the information which they contain. It is, however, well known that the average Filipino attaches much greater importance to what he sees than to what he reads, if indeed he is able to read, and it is unquestionably true that if the masses are to be reached and agricultural conditions in the islands are to be generally improved it must be by practical demonstrations so conducted as to bring to the attention of the common people the advantageous results following the employment of improved culture methods and modern agricultural machinery. It is in this eminently practical work that the bureau has shown itself to be weak, and improvement in this regard must be had. While it is true that serious obstacles have been encountered in the carrying out of this work, I am of the opinion that the results obtained have not been commensurate with the opportunities presented and the funds appropriated.

CHANGES IN WORKING FORCE.

The working force of the bureau has been augmented during the past year by the appointment of an assistant chief, a director of animal industry, a superintendent of the stock farm, and a director of the agricultural college and experiment station in western Negros. The botanist who was originally an employee of the bureau has been transferred to the bureau of government laboratories, where, under existing provisions of law, all biological work for the insular government and its bureaus is carried on.

The bureau suffered two serious losses during the year. Mr. J. W. Gilmore, the fiber expert, who was doing excellent work, resigned in order to accept a college position in the United States. Mr. Clarence W. Dorsey, the soil physicist, whose work during his comparatively brief sojourn in the islands was admirable, but who had been only temporarily loaned to us by the United States Department of Agriculture, returned to Washington to resume his regular duties. During his stay in the Philippines he secured the data for a bulletin on general soil conditions in the Philippines, and made special investigations into the soils of Union Province, the soils of the forest areas, and the soils of Batangas Province, embodying the results of his work in bulletins of much practical value. Before his return to Washington, Mr. Dorsey prepared plans for continuing soil work. The services of a competent man have recently been secured, and the work will be prosecuted as rapidly as possible along the general lines suggested by Mr. Dorsey. The highly practical nature of this work and the great importance of some of the results which have been obtained in the United

States are too well known to require discussion. It is confidently believed that results of far-reaching importance will be obtained in the Philippine Islands.

WORK OF THE CLERICAL FORCE.

The clerical force of the bureau has been kept busy in systematically arranging its records, translating into English important articles bearing upon agricultural subjects connected with the islands and numerous letters and reports from Spanish-speaking correspondents, and in compiling information relative to the agricultural products of the islands, which has continued to come in in response to circular letters of inquiry.

PUBLICATIONS OF THE BUREAU.

The following bulletins and publications have been issued during the year:

- Cacao Culture in the Philippines, by Wm. S. Lyon; English and Spanish editions.
- Modern Rice Culture, by Wm. S. Boudreau; English and Spanish editions.
- Preliminary Report on the Commercial Fibers of the Philippines, by J. W. Gilmore; English and Spanish editions.
- Cultivation of Tobacco, by Clarence W. Dorsey; English edition.
- Report on the Introduction and Distribution of Seeds and Plants by the Bureau of Agriculture, by Wm. S. Lyon; English edition.
- The Cocoanut, by Wm. S. Lyon; English edition.
- A Report on the Agricultural Soils of Union Province, by Clarence W. Dorsey; English and Spanish editions.
- Preliminary Report on the Abacá Lands of the Philippines, by Clarence W. Dorsey; Spanish edition.
- Soil conditions in the Philippines, by Clarence W. Dorsey; English edition.
- Botanical work in the Philippines, by Clarence W. Dorsey; English edition.
- Botanical work in the Philippines, by Elmer D. Merrill; English edition.

There has also been published a Spanish translation, by Sixto de Sandejas, of a paper on fungoid diseases of locusts, which first appeared in the Yearbook of the United States Department of Agriculture.

These bulletins and publications contain a large amount of practical information which should be of great use in enlightening the public as to agricultural possibilities in the Philippines and in aiding the more intelligent Filipino agriculturalists to improve their methods of cultivation.

SEED AND PLANT DISTRIBUTION.

The free distribution of seeds and plants to Filipino agriculturalists has been continued upon a considerable scale. This work has been complicated by the fact that seeds deteriorate rapidly during that portion of the year when the air is very damp. A large amount of seed which would not germinate has been distributed by the bureau, and this fact has tended to discourage persons who had become interested in experimentation with American seeds and who went to more or less trouble and expense in planting dead seeds sent to them. Trial grounds for testing seeds have been established at Manila, and the sending out of dead seeds should be carefully avoided.

PROPOSED IMPROVEMENT OF NATIVE FRUITS.

The chief of the bureau, in his annual report, calls attention to the excellence of many of the native fruits and vegetables, the facility with which they may be grown and the certainty of yield, and to the desirability of conducting experiments relative to their improvement. There can be no question as to the desirability of such experiments. I trust that they may be pushed to conclusions and that practical results may be obtained.

EXPERIMENTS IN GROWING COFFEE.

As I have heretofore stated, the coffee plantations of Batangas, which were formerly such a source of revenue to the inhabitants, have completely disappeared as a result of the ravages of borers and of leaf blight. A tract of good coffee land in this province has been secured by the bureau of agriculture, which hopes to rehabilitate the coffee industry in Batangas by demonstrating that immunity from disease and insect pests may be obtained by the selection of vigorous varieties of coffee and the adoption of the best systems of cultivation and treatment. Some time must elapse before the practical value of the experiments which it is proposed to undertake can be demonstrated.

FIBER INVESTIGATIONS.

Probably no country in the world produces a greater number of valuable fiber plants than do the Philippine Islands. The fiber expert of the bureau has prepared for publication a preliminary report upon the commercial fibers of the Philippines, and has also made investigation and report on the abacá (Manila hemp) industry in the islands and the causes leading to the production of inferior fiber. The information furnished on the latter subject was of great value to me in drafting legislation providing for government inspection of abacá intended for export.

EXPERIMENT STATION AT MANILA.

Work at the experiment station at Manila was considerably hampered by the extraordinary drought of the past year and the lack of suitable facilities for irrigation. Tomatoes, onions, lettuce, radishes, lima beans, string beans, eggplant, peppers, okra, sweet corn, peas, sweet potatoes, and beets were, however, successfully grown.

When it is remembered that the vegetables at present consumed in Manila are chiefly imported from China, where cholera and bubonic plague are practically endemic, and where human excreta are used for manuring vegetable gardens, it will be readily seen that the success of this effort to grow vegetables in the vicinity of Manila is important. I am strongly in favor of excluding all vegetables grown in China as soon as an adequate supply can be grown in the islands.

Another important result obtained at this experiment station has been the successful growing of teosinte. Forage is in great demand at Manila, and the price is so high as to be practically prohibitive for the poorer classes. The experiments showed that upon well-fertilized ground with proper management it is reasonable to expect a minimum

of 100 tons of teosinte fodder to the acre per year. The crop actually grown was sold green at \$10 gold per ton, and it seems evident that the culture of this valuable forage plant will bring handsome returns.

Sesamum was also grown with success, both during the dry and during the rainy seasons, the gross value of the seed crop being \$19.80 gold per acre. It is believed that three crops can be grown on a given piece of land during the year. Tobacco from Sumatra seed was also very successfully grown, producing fine wrappers.

GOVERNMENT FARM AT SAN RAMON.

Work on the government farm at San Ramon, in the district of Zamboanga, has been continued during the year. The work upon this, as upon all experiment stations in the islands, has been greatly interfered with during the past year by the drought, which even killed many of the abacá plants. Some additional buildings have been erected on the farm, and the existing plantations of abacá and cocoanuts have been put into shape. The chief of the bureau of agriculture strongly recommends in his report that steps be taken to extend the area under cultivation in cocoanuts on this farm. In this connection it should be said that many months since I requested him to prepare and submit plans for the systematic increase of the cultivated area on this farm. The plans submitted to me in response to this request contemplated the substitution of the present very efficient superintendent, Mr. Havice, who is paid \$1,800 a year, by another gentleman who was to receive \$3,500 per year, but whose services have since been secured for the bureau of agriculture at \$1,500 per year.

These plans, involving as they did a heavy increase in the salary list of the farm and very largely augmented running expenses, were disapproved by me. It should be possible, under the direction of the present superintendent, by suitably increasing the force of laborers, to rapidly extend the cultivated area and within a few years to make this farm pay all of the expenses of the bureau of agriculture.

EXPERIMENT STATION IN BATANGAS.

The land originally chosen for an experiment station in the province of Batangas proved unsuited to this purpose, as it became so dry as to be useless during the hot season, and irrigation was not practicable. Practical demonstrations of the utility of modern agricultural machinery were given on a number of occasions in the province. It was shown, among other things, that a carabao could haul a 6-inch American plow, and as a result every plow of this description in Manila was sold within the next two or three weeks.

On account of the unsuitableness of the tract originally selected I was disposed to direct the discontinuance of experimental work in Batangas, but Capt. D. H. Boughton, treasurer of the war emergency rice fund for the province, strongly opposed such action on my part, promising to turn over to the bureau 25 acres of good land together with the necessary buildings for an experiment station, a windmill to pump water for irrigation, and a paid-up lease on the land for five years. This he did on June 30, 1903. The buildings consist of a dwelling house and office, a stable, and an 80-foot windmill with a

capacity of 3,000 gallons per hour. Important practical results have not as yet been obtained at this station, and indeed ought not yet to be looked for, owing to the shortness of the time which has elapsed since the property was secured.

EXPERIMENTS AT BAGUIO, BENGUET.

On November 13, 1902, I directed that Mr. Thomas Hanley be sent to Baguio, in the province of Benguet, to continue his studies of the agricultural conditions there. Mr. Hanley was subsequently also put in charge of the improvement of the grounds about the buildings of the insular government at Baguio. He developed remarkable ability in handling Igorrote labor, and accomplished wonders in improving the grounds with the very limited appropriation at his disposal for this purpose. He carried on an extensive series of experiments as to the fitness of the soil at Baguio for growing the vegetables and grains of the Temperate Zone. The seeds planted by him germinated readily and grew well for a time, but just at the period when they had to begin to depend upon the soil for nourishment, the young plants, with few exceptions, sickened and died, showing that the soil either contained some injurious element or lacked some essential one. It will now be necessary to make a careful and detailed chemical examination of the soil, which has every outward appearance of being excellent. It is worthy of note in passing that pumpkins, squashes, and cucumbers formed an exception to the general rule and flourished where other vegetables languished.

In view of the fact that the Commission has taken action providing for the establishment of the summer capital of the islands at Baguio, it becomes increasingly important to overcome the difficulty at present experienced in growing vegetables at that place, and further investigations to this end will be conducted.

Meanwhile I have directed the transfer of the experiments to the neighboring Trinidad Valley, distant about 3 miles, where land has been set aside by executive order of the civil governor for this purpose. The provincial inspector, Senor Emigdio Octaviano, has grown there successfully sweet corn, tomatoes, red peppers, endive, beets, turnips, peas, beans, squashes, cucumbers, carrots, spinnach, lettuce, cauliflower, celery, and oats. He informs me that wheat was raised there successfully during the Spanish régime.

The Trinidad Valley is said to be about 500 feet lower than Baguio. The slight resulting difference in temperature could hardly account for the widely different results obtained from experiments in the growing of vegetables in the two localities, and the conclusion seems inevitable that the explanation of the results obtained is to be sought in varying soil conditions. The ground used for experimentation at Baguio was newly plowed. It may be that continued cultivation with the use of suitable fertilizers will result in overcoming the difficulties heretofore encountered. The valley at Baguio has, it seems, always enjoyed a bad name among the Igorrotes as an agricultural region. In any event, the Trinidad Valley contains sufficient land to produce all the vegetables which are likely to be needed by the inhabitants of the city which will doubtless eventually spring up at Baguio.

AGRICULTURAL COLLEGE.

By act No. 512, passed November 10, 1902, the work of establishing an agricultural college was transferred from the bureau of public instruction to the bureau of agriculture, and the government farm known as "La Granja Modelo" in western Negros was set aside as a site for this school and for an experiment station to be conducted in connection with it. I was particularly anxious that the work of establishing this school, which is badly needed, should be pushed. My requests for the submission of plans for the necessary buildings were met by recommendations for the appointment of a portion of the teaching staff for the school. As it did not appear that teachers could be usefully employed prior to the erection of buildings in which they could teach and the gathering of students to be instructed by them, I declined to approve this proposal, and insisted upon the preparation of rough plans for the buildings needed, so that they could be submitted to the insular architect as a basis for finished plans and estimates of cost. After long-continued delay, plans for a main building, to contain laboratories, class rooms, offices, and a dormitory for students, were prepared. Twenty-five thousand dollars have been appropriated for the construction of this building. On March 25, 1903, a director of the experiment station was appointed, in order that he might take charge of the government property on the estate and begin the work of getting land under cultivation. Much valuable time has been needlessly lost in establishing this college.

ANIMAL INDUSTRY.

No work which legitimately falls within the scope of the bureau of agriculture is at present more important than that of animal industry. With the dreadful losses of horned cattle, due to rinderpest; the heavy call for native horses in Manila, which has resulted in draining the provinces of good animals and their transportation to the capital of the islands, where many of them have died from abuse; and the ravages of surra and glanders among the horses of the archipelago, it has become increasingly important to restock the islands with the draft animals to which the Filipinos are accustomed, as well as to introduce new draft animals and improve existing breeds. A stock farm where breeding experiments can be conducted has been established on the island of Culion. Seventy imported calves, 3 American mares, 2 Australian mares, 16 native mares, 6 mules, and 1 Arabian stallion have been sent there. The location selected for this farm seems to be an ideal one, and the animals upon it are in excellent condition. A large number of animals for breeding, for which requisition was made on December 1, 1902, and April 21, 1903, which are to come from the United States, Italy, India, and Java, have not been received, owing to transportation difficulties, but when they arrive experiments of great interest and importance to the islands will be possible.

It should be stated that Dr. Harry H. Dell, who is in immediate charge of the work in animal industry, has, by my direction, given a large part of his time to aiding the board of health and the bureau of government laboratories in the work of inoculating the horned cattle of the archipelago against rinderpest. I deem the pushing of this

work in provinces where rinderpest exists to be of more immediate and vital importance than any other branch of work in animal industry.

Mr. A. J. Washburne, who was appointed manager of the stock farm and who very energetically and capably conducted the preliminary work of establishing it, was on April 9 detailed to accompany the insular purchasing agent to make investigations preliminary to the purchase and importation of carabaos for distribution in the Philippine Islands. Mr. Zalmon K. Miller, expert in farm machinery and farm management, was made acting manager of the stock farm during the absence of Mr. Washburne.

CARE OF CARABAOS IMPORTED BY THE GOVERNMENT.

The work of caring for the carabaos imported at Manila by the government prior to their distribution through the provinces naturally fell to the bureau of agriculture, but the same inability to grapple promptly and successfully with practical problems which has characterized the bureau in dealing with various other important enterprises was manifested to such a degree that, with the approval of the civil governor, I relieved the bureau of this duty and imposed it upon the officers and employees of the serum laboratory, by whom it has been efficiently performed.

GOVERNMENT RICE FARM.

In my last annual report I stated that an experiment station for the growing of rice upon a large scale was to be established near the center of the great rice-producing area extending from Manila to near Dagupan. This statement was based upon the fact that the Commission had committed itself, in a general way, to the establishment of such a farm, in order that the value of modern agricultural machinery and modern culture methods in connection with the rice industry might be demonstrated to the Filipinos. The chief of the bureau of agriculture had submitted figures showing that the establishment of such a farm would be, from a pecuniary standpoint, a profitable investment of government funds, and had informed me that the refusal of suitable lands between Bacolor and Pampanga had been secured upon the basis of payment to the owners of one-fourth of the annual rice crop, this arrangement to continue for two years, with the option of renewing it at the end of that time for a like period.

Some time was lost in securing from the chief of the bureau satisfactory detailed estimates of the cost of the necessary machinery, seed, draft animals, and buildings. When it was found that 100 mules would be required to carry on the work upon this farm, the Commission hesitated to make the necessary appropriation, on account of the danger of losing the mules from surra. On February 11, 1903, however, act No. 634, authorizing the establishment of a government rice farm, not to exceed 2,000 acres in extent, and appropriating \$63,221 for its equipment and maintenance, was passed by the Commission. It then proved that the provisional arrangement entered into by the chief of the bureau of agriculture with the owners of the tract of land above referred to was not binding upon the owners, who refused to live up to their original agreement.

My first intimation that difficulty had arisen in securing this land came when I received at Baguio, in the province of Benguet, a request that I approve the expenditure of a large sum for the erection of buildings upon a tract of land in the province of Tarlac, which had been selected for the farm. Before approving such expenditure I deemed it advisable to ascertain for how long a period and upon what terms this tract of land had been rented. Inquiry on these subjects elicited the reply that only temporary control of the land had been secured, and developed the further astonishing fact that arrangements had been entered into for leasing it prior to the running of lines to determine whether or not the land could be irrigated, and that the subsequent running of such lines had shown the impracticability of irrigating a sufficient area. The plan of investing heavily in government buildings upon this property, temporarily secured, and unsuited to the purpose for which it was obtained, was therefore disapproved. A certain amount of cultivation, however, was undertaken by Mr. Boudreau, who had been put in charge of the farm, and was carried out by him in the face of many obstacles.

The only important result thus far obtained seems to be that the practicability of using American mules continuously for heavy field work through the months of May, June, and July has been demonstrated, and that while the question of suitable forage for mules is at present a somewhat serious one, corn does well in the Philippine lowlands, cowpeas are likely to succeed, and upland rice makes a superior hay. These three crops supply satisfactory forage for mules, so that the difficulty of feeding them is by no means insuperable.

The chief of the bureau of agriculture in his annual report quotes the recommendation of the superintendent of the rice farm "that steps be taken at once to secure a more suitable location for the farm," and, presumably, approves it. It therefore appears that we are no further advanced in the practical work of establishing a rice farm than we were at the time the appropriation for it was made. The superintendent of the rice farm in his report further says: "After the tract has been located, a thorough survey should be made, and the question of natural or artificial irrigation will have to be considered and cost thereof." In these suggestions, apparently born of recent experience, I emphatically concur.

For further details relative to the work of the bureau of agriculture during the past year, reference is made to the report of the chief of the bureau, which is appended hereto and marked Appendix I.

THE WEATHER BUREAU.

Under the able directorship of the Rev. Jose Algue, S. J., the efficiency of the Philippine weather bureau continues to increase as the extension of telegraph and cable lines and the restoration of peaceful conditions make communication with the several weather stations throughout the islands quicker and less subject to interruption. This bureau is unique in that practically all of its officers and employees, with the exception of the director and three assistant directors, are Filipinos. The employees include first, second, third, and fourth class observers, calculators, clerks, draftsmen, and the mechanics who repair the numerous complex and delicate instruments used in the service, and who even construct such instruments.

WEATHER STATIONS.

There are at present established and in operation 7 first-class stations, 11 second-class stations, 23 third-class stations, and 13 fourth-class stations. Gubat, a third-class station in the province of Sorsogon, island of Luzon, is an important addition to the list and will probably soon be telegraphically connected with the central station at Manila.

The suggestion is made by the director of the weather bureau that a cable be extended to the small island of San Bernardino at the Pacific entrance of the San Bernardino Straits, and that a station be erected there, so that warning signals may be displayed for the benefit of vessels coming from America before they enter the interinsular and China seas.

The importance of establishing a station of the weather bureau at Guam, so that information as to the origin and progress of typhoons in the vicinity of that island may be communicated to Manila and that warnings of storms in the track of vessels between Guam and the Philippines may be sent to the former place, has been brought to the attention of the Commission by the director of the weather bureau and that body has resolved that a station should be established at Guam and has taken the necessary steps to that end by opening communication with the naval authorities holding jurisdiction over the island. An observer is ready to be sent there and the station will be established promptly should it prove practicable to make satisfactory arrangements with the naval authorities. It is to be regretted that the Commercial Pacific Cable Company has declined to grant the free transmission of weather reports from Guam to Manila, thus departing from the liberal policy which has been pursued by the Eastern Extension, Australia, India and China Cable Company.

A systematic inspection of the weather stations has been kept up during the past year with beneficial results, as many of the observers are not sufficiently expert to detect inaccuracies in their instruments or to remedy defects when discovered.

NEW INSTRUMENTS.

A new Universal Vicentini's microseismograph and a new ceraunograph have been constructed by the mechanics at the central station, and will be exhibited at the Louisiana Purchase Exposition. A Jordan's sunshine recorder has been sent to the station at Catbalogan for purposes of experimentation. A statescope, an electric chronograph employed for transmitting official time to the different stations in the Philippines, an actinometograph, and an evaporimetograph have been added to the equipment of the central station at Manila.

CROP SERVICE.

The crop service inaugurated by the weather bureau in 1901 has steadily increased in importance. Information has been received during the past year from 299 municipalities in 33 provinces.

ESTABLISHMENT OF STORM SIGNALS.

On the recommendation of the director of the weather bureau, the necessary appropriation has been made for establishing storm signals

at Zamboanga, Romblon, Catbalogan, Tacloban, Surigao, Jolo, Legaspi, Antimonan, Corregidor, Lucena, and Olongapo. The installation of these signals will materially facilitate the communication of storm warnings to vessels at these important ports.

PUBLICATIONS OF THE BUREAU.

The publications of the bureau during the past year consist of the regular monthly bulletins, and the following separate papers:

The third part of the report of the director of the bureau for 1902, containing the hourly observations of atmospheric phenomena at the Manila central observatory during the calendar year 1902.

The fourth part of the same report, containing hourly magnetic observations in Manila during the same year (in press).

The fifth part of the same report, embodying a résumé of the meteorological observations in branch stations for the calendar year 1902 (in press).

The first of a series of pamphlets on theoretical and practical meteorology, entitled "rain" (la lluvia). The series of pamphlets, of which the one on rain is the first, is intended for the use of observers in the weather stations throughout the islands.

An article on the climate of the Philippine Islands, to be published in the report of the census of the Philippines.

An article by Father Algue, director of the bureau, on the climate of the Philippines.

A very exhaustive article on seismic phenomena in the Philippines, by Rev. Father Miguel Saderra Masó, for publication in the report of the Philippine census.

Finally, a new English edition of Father Algue's very important work on "Baguios," or Philippine cyclones, has been made ready for publication.

EXHIBIT AT THE LOUISIANA PURCHASE EXPOSITION.

Arrangements for an adequate exhibit of the bureau at the Louisiana Purchase Exposition have been perfected, and the bureau has prepared large relief maps of Manila Bay, Taal Volcano and Mayon Volcano, to be exhibited at the exposition. Father Algue will shortly proceed to St. Louis to construct a large relief map of the Philippines on the exposition grounds.

REPAIRS OF INSTRUMENTS.

Owing to the peculiar climatic conditions in the Philippines, a large amount of patient and delicate work is required to keep the numerous instruments of precision at the central station at Manila and at the several provincial stations in good working order. This work is done in an admirable manner by Filipino mechanics, who have kept the instruments at the central observatory in proper condition for work; prepared, checked, and packed all instruments sent to branch stations; and repaired many instruments belonging to branch stations, to the United States Army, the United States Navy, civilian officials and private individuals. More than fifty aneroid barometers and several mercurial barometers have been repaired and rated.

ASTRONOMICAL WORK.

The astronomical department of the observatory has furnished standard time daily by telegraph to all telegraph offices in the archipelago, and by time ball to vessels in Manila Bay; has observed the eclipse of March 28, 1903; has kept up regular observations of solar activity, with drawings of sun spots in connection with magnetic observations; and has rated 39 chronometers. Transits of stars are regularly observed for the purpose of rating the standard pendulum and the chronometers.

MAGNETIC OBSERVATORY.

The work of the magnetic department of the observatory has been materially interfered with during the past year by galvanized-iron roofs upon neighboring stables established for the accommodation of horses used for government transportation. It will probably be necessary either to remove the iron roofs or to locate the magnetic observatory elsewhere.

PROMOTION WITHOUT COMPETITIVE EXAMINATION AUTHORIZED.

During the year the bureau has been authorized by the civil-service board to promote observers, calculators, assistant observers, and assistant calculators who have been more than four years in the service to higher rank without the necessity of competitive or other examination, provided such promotions are not made to positions paying salaries of more than \$900 per year.

The chief of the bureau has been authorized, by act of the Commission, to change the location of weather stations fixed by law, in his discretion, if, as the work of establishing stations progresses, he finds that in some instances places other than those named in the original act providing for their establishment are better suited to the requirements of the weather service.

The first of these authorizations will, it is believed, tend to encourage faithful discharge of their duties by the employees whom it affects. The second was found to be necessary for the reason that variation from the original plan for the establishment of telegraph and cable lines in the archipelago left certain points originally designated as sites for important weather stations without telegraphic communication, and for the further reason that certain other points have been shown by actual experience to be unsuited for weather stations.

For further details relative to the work of the weather bureau during the past year, reference is made to the annual report of the director of the bureau, which is appended hereto and marked Appendix J.

THE ETHNOLOGICAL SURVEY FOR THE PHILIPPINE ISLANDS.

The name of the bureau charged with the duty of gathering information relative to the non-Christian tribes of the archipelago has been changed from "the bureau of non-Christian tribes" to the more fitting designation of "the ethnological survey for the Philippine Islands."

NECESSITY FOR SURVEY.

The policy of spending insular funds for this work has been made the subject of criticism by various persons, among whom were some individuals whose injudicious or culpable actions in dealing with the non-Christian peoples of the islands were brought to the attention of the proper authorities through the activity of employees of the survey.

I am unable to see how the insular government could hope successfully to undertake to protect the wild tribes of the islands from imposition at the hands of civilized Filipino, American, and other residents, or to establish local governments for them, in the absence of accurate and reliable information concerning them and their relations with their neighbors. The desirability of obtaining such information is self-evident and need not be discussed.

TRANSFER OF THE CHIEF OF THE BUREAU.

Dr. David P. Barrows, the chief of the ethnological survey, has recently been appointed general superintendent of public instruction. Although he temporarily retains general charge of the survey, his new duties necessarily consume the greater part of his time. The loss to the survey which must result from this transfer is serious and is greatly regretted by me. Doctor Barrows was peculiarly fitted successfully to carry out this survey, and it will be very difficult to find anyone who can satisfactorily take his place.

WORK OF THE SURVEY.

During the past year a preliminary exploration of all the previously little-known parts of the islands has been nearly completed. It is believed that by the time this report goes to the press field parties of the ethnological survey will have visited practically every non-Christian tribe in the archipelago, and secured the geographical and ethnological data necessary to complete our knowledge as to the number of non-Christian tribes, and the general habitat and more important peculiarities of each of them.

The necessity of securing this information at an early date, and of making necessary preparations for an adequate representation of the non-Christian tribes at the coming Louisiana Purchase Exposition at St. Louis, has kept the employees of the survey almost constantly in the field, and has prevented to a considerable extent the preparation for publication of the scientific results achieved.

The officers and employees, from the chief down, have shown commendable energy and perseverance in pushing their explorations, which have frequently involved no little hardship and danger. The difficulty of their undertaking will be realized when it is remembered that the territory occupied by non-Christian tribes embraces considerably more than half of the superficial area of the archipelago, and is for the most part rugged and without roads or even pony trails.

In September, 1902, a party consisting of the chief and assistant chief of the survey, the government photographer, and Señor Vicente Garcia entered upon an extensive reconnoissance of the tribes inhabiting the mountain region of north-central Luzon. This party started from Ambuklao, in Benguet, visited the old comandancia of Quiapa

(Kayapa), ascended Mount Ugu, the highest peak in the southern part of the Cordillera Central, and entered Nueva Viscaya, going by way of Santa Cruz de Manga to Aritao and Dupax. From the latter point a short trip was made to visit the little known Ibilao, in the mountains to the eastward.

The party then entered the district of Quiangan (Kiangnan), in Nueva Vizcaya. In this region the natives were found to be still actively engaged in head-hunting, and progress was made difficult and dangerous by the local feuds. The party therefore turned back and proceeded to Iligan, the capital of the province of Isabela. From this point as a base, the Kalinga villages in the foothills of the Sierra Madre were visited.

The party then worked its way through the Cordillera Central to Bontoc by way of Itaves and the Rio Chico, returning to Baguio, the capital of Benguet, by way of Cervantes, Suyoc, and the Agno River Valley. This trip, involving great physical hardship and no little danger, resulted in the gathering of very interesting and important information relative to the geography of the region traversed and to the character of the great Igorrote family of mountain tribes. A large series of photographs was secured and brief vocabularies of eleven distinct native dialects were made.

In February, 1903, the services of Dr. N. M. Saleeby were secured for the survey. Doctor Saleeby, whose native tongue is Arabic, was a member of the army medical corps, and had been serving for a year and a half among the Moros inhabiting the Rio Grande and Lake Lanao regions in Mindanao, where he had established friendly personal relations with many of the more influential chiefs and priests, from whom he had obtained originals or copies of practically all existing Moro historical, religious, and legal documents, many of which he had translated. Doctor Saleeby was appointed assistant to the chief of the survey and put in charge of the work of the survey which related to Moro affairs. He subsequently gathered much important information relative to the Moros of Jolo and the intrigues which prevail among them. The data gathered by him will be of the greatest importance in establishing effective civil government in the recently created Moro Province.

Beginning in March, the chief of the survey, accompanied by Doctor Saleeby, entered upon a systematic exploration of the Moro country and of the Sulu and Tawi Tawi archipelagoes, Basilan, and southern Mindanao.

The results obtained during the year by the chief of the survey will be published in the form of brief monographs on "The Tribes of the Cordillera Central of Northern Luzon," "Notes on the Ibilao," "Notes on the Mangyan of the Baco River, Mindoro," "The Subanon of Western Mindanao," "The Mohammedan Tribes of the Philippine Islands," and "A Contribution to the Classification of the Races of the Philippines."

To Dr. Albert E. Jenks, assistant chief of the survey, was assigned the duty of making a detailed study of the Igorrotes of Bontoc, who were believed to be as typical of the large group of primitive peoples inhabiting the mountain region of northern Luzon as any tribe which could be selected. Doctor Jenks spent five months in Bontoc, beginning in January, 1903. Mr. Charles Martin, the government pho-

tographer, was detailed to serve with him during three weeks of this period. He has prepared an elaborate and profusely illustrated monograph on the Bontoc Igorrot, which will be published in the near future. He has obtained results which will be of great practical importance in governing this very primitive tribe.

The work of gathering and filing data and information from all available sources concerning the non-Christian tribes of the Philippines has been systematically prosecuted during the past year by Chief Clerk Reed, who has made numerous translations, from Spanish, French, and German, of articles having a bearing on the work of the survey. Mr. Reed also installed a small ethnographical exhibit from the survey at the Hanoi Exposition in Indo-China.

In June, 1903, he was delegated to make a study of the Negritos inhabiting the Zambales Mountains. He secured a large amount of accurate and interesting information concerning this little-known people during his trip, which occupied a number of weeks. Later he carried out a rapid survey of the province of Occidental Negros, ascertaining the character and location of the mountain tribes of that province.

The survey has been fortunate during the past year in having the services of Messrs. Miller and Folkmar, both of whom are doctors of philosophy in anthropology, in preparing the ethnological exhibit for the Louisiana Purchase Exposition.

Doctor Miller has made a trip across Mindoro with the primary object of obtaining ethnologic material from the Mangayan tribe, but the portion of the island traversed was found to be almost uninhabited.

Doctor Miller subsequently visited the country in the vicinity of Bulalacao, in the same island, but his work was interrupted by malarial fever, which necessitated his return to Manila.

In August he went south to Surigao, in Mindanao, to study the Negrito inhabitants of that province and to ascend the Agusan River, where he encountered Manobos and Mandayas.

Doctor Folkmar has been continuously occupied with physical anthropometry in Bilibid Prison, measuring some 800 individuals, among whom were represented all of the Christianized Filipino tribes, and taking 4 photographs of each of about 400 individuals.

A number of collectors have also been delegated to visit different regions in the archipelago and obtain information for the survey and material for the Louisiana Purchase Exposition.

Several very valuable contributions to our knowledge of the non-Christian tribes of the islands have been made during the past year by Filipino and other volunteer workers. Among these may be mentioned:

The Ifugaos, by Señor Wenceslao Valera, Bayombong, N. V.

The Buquidnones of Oriental Negros, by Señor Santiago Gonzales.

The Negritos of Cagayan, by Señor Pedro Daña.

Manguianes, by Señor Servulo Leuterio, Calapan, Mindoro.

Negritos of Bataan, by Señor Vicente Rodriguez.

Tinguianes, by Señor Emeteru Molina, Dolores, Abra.

For further information relative to the work of the ethnological survey and for an interesting account of the conditions which prevailed under the Spanish régime in territory inhabited by non-Christian tribes, as well as for an admirable summary description of the pagan

tribes of the Philippines, reference is made to the annual report of the chief of the survey, which is appended hereto and marked Appendix K.

NOTE.—It should be noted that the chief of the survey has in his report employed a “reformed spelling” in writing the names of the tribes to which he has referred, and in some instances has departed so far from the spelling employed by Spanish authorities, and by the Commission in its laws, as to cause danger of confusion in the mind of the reader. His report would have been improved by the addition of a list of the tribes mentioned therein, showing the names used by him and the equivalent names heretofore employed for the same peoples.

Very respectfully,

DEAN C. WORCESTER,
Secretary of the Interior.

The PHILIPPINE COMMISSION,
Manila, P. I.

APPENDIX A.

REPORT OF THE COMMISSIONER OF PUBLIC HEALTH FOR THE PHILIPPINE ISLANDS FOR THE YEAR SEPTEMBER 1, 1902, TO SEPTEMBER 1, 1903.

SEPTEMBER 15, 1903.

SIR: I have the honor to transmit herewith a report showing the operations of the board of health for the Philippine Islands and city of Manila for the twelve months' period from September 1, 1902, to September 1, 1903.

It may be stated as a general proposition, unfortunately too often accepted without appreciation of its true importance, that the health of any community is its most valuable asset. Upon the health of man and beast depends their power to work, as a result of which alone a fair degree of prosperity may be secured and maintained by the individual and community. In the absence of good health and earning capacity not only bodily suffering but financial distress prevails. If the several classes are so affected by sickness or death in the community as to be unable to perform their accustomed tasks, or if pestilence among animals interferes with or prevents the carrying on of agriculture or traffic, the income of these classes ceases, and without sufficient accumulated funds in reserve they are unable to pay the taxes through which all departments of the government are supported and improvements can alone be accomplished. In extreme cases the poorer classes may cease to be self-supporting and become a charge upon the government instead of a source of its maintenance. Finally, in time of pestilence the necessary quarantine regulations imposed by more healthful communities so interfere with the natural movement of trade that not only may business interests be hindered or paralyzed and customs receipts be greatly diminished, but the cost of living in the districts afflicted with epidemic disease is materially increased.

The truth of this general proposition would seem to have been amply demonstrated by events in the Philippine Islands during the past eighteen months. Through the existence of cholera, rinderpest, and surra, these islands, naturally one of the garden spots of the world, have been commercially prostrated. With practically a hundred thousand deaths from cholera officially reported, and half as many more persons attacked, nearly every community has been invaded by the disease. Many producers have lost their lives or have been kept from work through terror or the necessity of caring for the sick in their immediate families. The cholera in many instances has committed its worst ravages during the time when the rice and tobacco crops should have been planted or when the hemp should have been gathered. In some districts the recent loss by disease of more than three-fourths of the bovines and more than half the equines has made it impossible to put in the usual crops or even properly harvest those at hand. With the establishment of quarantines between towns, provinces, and islands the

internal trade of the archipelago was for a time practically brought to a standstill, while the establishment of quarantine against the whole archipelago by other countries seriously affected its deep-sea traffic through the main shipping ports. The people in many places have been unable to pay taxes or even to properly provide for their own subsistence, and it has been necessary to receive a large sum of money from the home government and to supply rice for the relief of the indigent. As a result the work of carrying out many needed improvements has been necessarily postponed for lack of funds, and a policy of general retrenchment with respect to the expense of conducting the government has been in order.

The matter of the prevention of disease should be viewed from two standpoints—the humanitarian and the economic. Too often the inseparable relation between good health and business prosperity is overlooked. Sentiments of humanity and practical business interests are equally concerned in averting preventable disease and should unite for the enforcement of proper sanitary laws with respect to the willful, the indifferent, or the ignorant. Not only do the sanitary authorities require full moral support in carrying out their work, but ample legal authority to enforce necessary orders, and sufficient funds to pay for securing the desired improvements are essential. Modern sanitary requirements unquestionably cost money, but any expenditure that prevents disease and improves the public welfare should be regarded as an investment yielding the largest returns, not only in respect to improved health and happiness, but also as an insurance of industrial prosperity which is directly measurable by dollars and cents.

For the above reasons the fact should be emphasized that in any community, and especially in these islands, governmental economy should begin elsewhere than in the sanitary department, and improved sanitary conditions should not be a signal for decreasing its appropriations. Improvement in health conditions is permanent only while proper sanitary measures are being applied. While the tremendous money loss directly depending upon preventable disease in these islands during the past two years is beyond calculation, it is safe to say that it would have supported a most thoroughly organized and completely equipped sanitary organization for the Philippine Archipelago for an entire generation. Sanitary efficiency is the key to the prosperity of these islands and thus to the success of their administration; in its absence every walk in life will be unfavorably affected, and the work of every other department of the government will be curtailed for lack of revenue. The interests of humanity, industry, and commerce thus unite to bespeak of the authorities a most liberal financial and moral support for the sanitary department.

All the suffering, want, and financial distress above mentioned have been the result of diseases which are generally recognized as of a preventable nature. If they are preventable, it is a fair question to ask why they have not been prevented. The answer to this is that the ideal is nowhere obtained, and that time, money, men, material, adequate laws, and a willingness on the part of the general public to cooperate with the sanitary authorities are required to bring about proper results. Nevertheless, a vast amount of good has unquestionably been accomplished, despite the difficulties presented in the way of coping with the situation. As instances of what has been accomplished, it is only necessary to mention the fact that but one-tenth as many

cases of cholera occurred in Manila during the eight months of the present year as in the nine previous months during which the disease had existed; and in the worst day of the entire epidemic of 1902-3 there occurred only about one-thirteenth of the number of cases which are said by European physicians long in practice in Manila to have developed in a similar period in the epidemic which prevailed twenty years ago under the Spanish administration. Within less than two years the entire situation with respect to rinderpest has been altered, and where 90 per cent of affected animals formerly died, under improved methods of preventive inoculation only about 3 per cent now succumb to the disease. Smallpox has ceased to be an important factor in the Manila death rate, vaccination being vigorously carried on, and the records showing that more persons were vaccinated in the first two months of the American occupation than had been vaccinated by the Spaniards during the five years previous, and more than fifteen times as many in the past twelve months as were vaccinated by the Spaniards in the five years just mentioned. The city has been brought into a sanitary condition never even approached under the previous administration, and the death rate has been so greatly reduced that it compares favorably with those not only for other cities in the Tropics, but even for certain cities in the southern part of the United States.

There has not as yet been time, however, in which to carry out all the improvements projected, nor have abundant funds been at once available for such purposes. For the salaries offered, it is difficult to obtain the class of men desired for the sanitary service, and with the United States so far away it is plainly impossible to procure on short notice the material and supplies required. The sanitary laws in force at present are not sufficiently comprehensive, but efforts are now being made to remedy deficiencies in this respect. Finally, whatever has been done has only been accomplished by constant endeavor and the exercise of much tact in the face of general opposition on the part of the natives, who are naturally slow to change the habits, customs, and ideas inherited from their forefathers, and who, being strongly imbued with superstitious beliefs and fatalistic ideas, can not understand the utility of carrying out the proposed reforms.

Undoubtedly the greatest obstacle to improving the condition of the native is the native himself. All these difficulties may become unimportant at some future time, but at present and in the past they have been very potent obstacles to the attainment of desired results. On the whole, however, the results which have been secured are a cause for much satisfaction. Every permanent improvement which can be carried out lightens by so much the sanitary burden for the future, and with proper support along present lines of work a steady betterment of sanitary conditions may be confidently expected. As in other cities, the sanitary department here is not popular with the lower classes, as it is above all others the service with which each individual comes more surely into personal contact and the regulations of which are, in these islands, so directly at variance with inherited ideas and racial customs. For this reason the sanitary department requires especially consistent support at the present time, until those for whom its work is being carried on arrive at a better appreciation of what is being done for them and come to understand that the enforcement of sanitary laws is for their benefit and not for their annoyance.

The great mass of the people lack education and are naturally suspicious and skeptical as to the efforts of the board of health. This fact has been appreciated by the sanitary authorities, and a policy of education and suasion has been pursued rather than one of force. This has been particularly true in respect to cholera and bubonic plague. There is no question but that the instruction given on sanitary matters has left its impression on native ideas, though obviously much still remains to be done in this respect.

Before taking up the report in its parts mention may be made that under existing law the board of health for the Philippine Islands acts also as the municipal board of health for the city of Manila. It is not practicable to wholly differentiate the dual functions of the board in this report, and where the same sanitary problem exists in Manila and throughout the islands it is more advantageously discussed under a single heading.

REPORT OF RECEIPTS.

During the year prior to September 1, 1903, the sum of \$31,037.73 local currency and \$6,548.77 United States currency was received by the cashier of the board of health. Of this sum, \$15,046.16 local currency and \$1,420.91 United States currency were received from the burial department, \$14,646.24 local currency and \$1,972.60 United States currency from the veterinary department, \$429.03 local currency and \$2,053.80 United States currency from the sale of vaccine virus, \$726 local currency and \$89 United States currency from subsistence, \$190.30 local currency from San Lazaro hospital, \$112.46 United States currency from commissaries.

During the year there were deposited with the insular treasurer the sums of \$27,362.54 local currency and \$5,108.73 United States currency; there were deposited with the city assessor and collector \$9,110.21 local currency and \$1,048.80 United States currency, making a total of \$36,472.75 local currency and \$6,157.53 United States currency.

REPORT OF DISBURSEMENTS.

The total expenditures for the twelve months prior to September 1, 1903, amounted to \$1,082,253.41 local currency and \$131,890.56 Philippine currency. Of these expenditures, \$236,415.42 local currency and \$29,524.27 Philippine currency were expended for the operation of the pail conservancy system, city of Manila; the sums of \$246,025.34 local currency and \$47,113.19 Philippine currency were expended on salaries and wages; \$144,394.57 local currency and \$8,137.27 Philippine currency were disbursed for support of hospitals, plants, etc.; \$370,326.58 local currency and \$33,180.93 Philippine currency were expended for the suppression and extermination of epidemic diseases and pests; the sums of \$66,533.48 local currency and \$2,381.15 Philippine currency were expended for transportation; contingent expenses amounted to \$18,558.02 local currency and \$2,643.07 Philippine currency, and the sum of \$8,910.68 Philippine currency was disbursed for salaries and wages.

This office can not but feel that while financially it has been as liberally treated as other departments, yet its sphere of usefulness, particularly in the provinces, might be much broadened by larger appropriations. It can not be too strongly emphasized that sanitary conditions in these

islands rest at the very foundation of all prosperity. In the presence of epidemic diseases there will be depression in every branch of business. Money is required not only for the legitimate expenses of conducting the routine sanitary work of the board of health, but also for the construction of much needed permanent sanitary improvements already too long delayed. Until the sanitary conditions in these islands are so improved that epidemic diseases in men and animals may not be liable to interfere to prevent a fair return on money invested, and until conditions are such that life and health on the part of those engaged in business enterprises may be regarded as reasonably secure, it is idle to expect that either business men or capital will be attracted to the archipelago.

DEPARTMENT OF SANITARY INSPECTION.

The work of this department during the year is excellently described in the appended report of the chief health inspector.

A vast amount of work has been done in Manila during the year by the average of 145 regular and emergency sanitary inspectors on duty. With the cutting down of the sanitary force by 75 per cent on June 30, there was naturally a corresponding decrease in the amount of work accomplished. During the year there were made 1,954,990 inspections and reinspections of houses; 241,806 houses were cleaned as a result of sanitary inspection; 1,196 houses were whitewashed and painted; 7,336 houses were disinfected; 82 houses were condemned and removed; 11,256 cesspools and vaults were cleaned; 161,447 cleanings of yards were carried out; 1,757 yards were repaired, repaved, etc.; 534 cholera cases, 71 smallpox cases, and 185 plague cases were reported; 5,479 sanitary orders were complied with by householders; 246 persons were convicted for violation of food prohibition order.

The matter of domiciliary visitation, while it does much good in many ways, has proved extremely irritating to those whose premises have been inspected, and there has been considerable complaint as a result. With the decrease in cholera and cutting down of the sanitary force there has been a considerable diminution in respect to house visitation, and this work may be still further reduced if such action can be consistently taken.

DEPARTMENT OF SANITARY ENGINEERING.

Attention is invited to the special reports, hereto appended, of the sanitary engineer of the Philippine Islands and the sanitary engineer for the city of Manila. The recommendations therein made are submitted for the careful consideration of the Secretary of the Interior.

DEATH RATE.

The mortality rate of Manila, under a recent resolution of the board of health, is now figured out on a basis of a population for the city of 219,941, as determined by the recent official census. The census count which had been previously conducted by the board of health placed the population at 244,732, and subsequent estimates raised these figures to 250,000, and later to 302,154. The director of the census having informed this office that the figures of 244,732 might be considered as approximately correct down to the time of the recent official census, all rates heretofore figured on higher estimates of population have

been thrown out and recomputed on a basis of 244,732 down to June 30, 1903, since which time the census figures of 219,941 have been used for computation. The latter figures for the total population are composed as follows: Filipinos, 189,782; Chinese, 22,125; Americans, 4,389; foreigners, 3,645.

There were 8,892 deaths among residents during the year, giving a death rate for the twelve months prior to September 1, 1903, of 37 per thousand. Of this number, 894 deaths were due to cholera and 166 to bubonic plague. The chief factor in the general mortality rate was the excessively high death rate among children.

The death rate by race, as computed by the last census returns, has been as follows: Filipinos, 43.42; Chinese, 28.26; foreigners, 18.72; Americans, 14.80.

Of the total deaths occurring in the city, including transients, 5,105 were reported as occurring in males and 3,906 in females.

In respect to age, 3,872 deaths occurred under the age of 1 year; 1,012 between 1 and 10 years; 400 between 10 and 20 years; 1,080 between 20 and 30 years; 1,020 between 30 and 40 years; 646 between 40 and 50 years; 501 between 50 and 60 years; 405 between 60 and 70 years; 209 between 70 and 80 years; 113 between 80 and 90 years; 71 between 90 and 100, and 28 persons are reported to have died at an age of more than 100 years. In 37 instances the age of the deceased was not reported.

The relative native sanitary condition of the different districts of the city during the year is shown by the mortality rate per thousand population, as determined by the figures of the last census and the records of the board of health. These are as follows:

District.	Death rate per 1,000.	District.	Death rate per 1,000.
Ermita.....	19.22	Intramuros.....	43.09
Malate.....	29.12	Sampaloc.....	45.63
San Nicolas.....	32.82	Quiapo.....	52.91
Binondo.....	36.23	Tondo.....	56.55
Santa Ana.....	38.70	Pandacan.....	58.52
San Miguel.....	39.60	Paco.....	88.32
Santa Cruz.....	40.69		

The lowest death rate, about the same as that of the best modern cities, is found in the Ermita district, in which resides a large population of whites and a well-to-do and high-class native population. The districts which have a relatively large Chinese population, like San Nicolas and Binondo, have a much lower death rate than the districts densely populated by the poorer class of Filipinos. Of course the death rate in the districts last named is largely raised by an unduly high infant mortality among the natives.

The present relative sanitary condition of the city, as compared with previous periods, basing statistics on the average of the first eight months of each calendar year, is as follows:

Period.	Relative rate.
January 1 to September 1—	
1900.....	39.66
1901.....	37.14
1902.....	64.81
1903.....	31.92

The rate of 31.92 has been attained in spite of the existence of the cholera infection in the city during every month of the present year, which disease was responsible for a number of deaths and contributed largely to the elevation of the death rate. In the years 1900 and 1901 cholera did not exist in the islands and was not a factor in the death rate. In 1902 it existed for but five of the eight months of the period under comparison. In spite of its occurrence during the present year, the death rate has been brought well below those for 1900 and 1901, and is less than one-half what it was during the same period a year ago, although the population may be regarded as just as susceptible to cholera now as then. Excluding the deaths from cholera during the eight months of the present calendar year, the death rate would be 29.45 per thousand, or a reduction of mortality in two years of 24.5 per cent. This result, in view of local conditions, is encouraging, and may be expected to obtain as soon as the cholera, which is to be regarded as an exotic in these islands, has disappeared from the archipelago. Further reduction in the death rate will unquestionably accompany more attention to the infant mortality, the installation of permanent city improvements relating to a new water supply, a general sewerage system, the improvement of the esteros, and the filling in of the sunken lands—the municipal board alone having the power to bring about these permanent improvements.

It is impossible to make any statistical comparison with respect to the mortality rates for the inhabitants of Manila prior and subsequent to American control. No statistical records of sanitary value were maintained by the Americans between the time of the capture of the city of Manila and January, 1900, when a local board of health was established by the provost-marshal-general. With respect to the records kept under the Spanish rule, these are missing, with the exception of an incomplete mortality report for the year 1896. It is stated by the clerk now in charge of such documents in the bureau of archives, who had the same duties under the Spanish Government, that the missing records were removed from the files and used as fuel for the cooking of rice in the confusion incident to the crowding into the walled city of a large number of refugees driven in by the insurrectos, and the subsequent capture of the city by the United States forces. As the figures for the year 1896 are incomplete to the extent of covering only 6 out of 13 municipal districts of Manila, they are consequently of no statistical value.

The recent recomputation of the mortality statistics on the basis of a smaller population than had previously been estimated has resulted in a less favorable sanitary showing for Manila than had previously been considered to exist. Exactly where Manila stands at the present time in this respect, in relation to various other cities, is shown by the following comparison of death rates per thousand population:

Manila, P. I., January 1 to September 1, 1903.....	31.92
Bombay, India, year 1901.....	76.66
Calcutta, India, year 1902.....	37
Madrid, Spain, October 1, 1900, to September 30, 1901.....	32.2
Cairo, Egypt, October 1, 1900, to September 30, 1901.....	34.8
Alexandria, Egypt, October 1, 1900, to September 30, 1901.....	37.3
San Luis Potosi, Mexico, October 1, 1900, to September 30, 1901.....	41.9
Moscow, Russia, October 1, 1900, to September 30, 1901.....	30.1
Trieste, Austria, October 1, 1900, to September 30, 1901.....	25.9
Dublin, Ireland, September 30, 1900, to September 28, 1901.....	24.9
Island of Ceylon, year 1900.....	28.6

Habana, Cuba, year 1901.....	22. 11
Naples, Italy, October 1, 1900, to September 30, 1901.....	25. 1
Modena, Italy, October 1, 1900, to September 30, 1901.....	27. 2
Charleston, S. C., year 1900.....	34. 94
Memphis, Tenn., year 1900.....	25. 1
Honolulu, H. I., year 1902.....	25. 59
New Orleans, La., year 1902.....	24. 74
New York, N. Y., year 1900.....	19. 01
Hongkong, China, year 1899.....	24. 33

The figures from Hongkong are misleading and do not represent the total deaths, as many Chinese affected with chronic diseases largely return to their ancestral homes in China to die.

On the whole, despite the fact that the present death rate in Manila is unduly elevated by reason of the presence of cholera, the sanitary showing of the city compares favorably with those for many other cities which have not had either plague or cholera infections to contend against. With the disappearance of the cholera infection from the islands within a few months, which, from the history of the cholera in the Tropics, may be confidently expected to occur, Manila will undoubtedly be able to take place as one of the most healthful of the cities located in hot climates.

The chief causes of mortality during the twelve months prior to September 1, 1903, with the number of deaths caused thereby, were as follows:

Convulsions of children.....	2, 038
Asiatic cholera.....	894
Pulmonary tuberculosis.....	789
Eclampsia, nonpuerperal.....	645
Bronchitis, acute.....	338
Chronic diarrhea and enteritis.....	322
Beriberi.....	313
Bronchitis, chronic.....	292
Meningitis, simple.....	278
Dysentery.....	236
Malaria and its results.....	226
Senile debility.....	187
Bubonic plague.....	160
Congenital debility in infants.....	130
Organic heart disease.....	122
Cerebral congestion and hemorrhage.....	108
Tetanus.....	108
Typhoid fever.....	102
Angina pectoris.....	91
Anæmia.....	60
Bright's disease.....	51

There were but 12 deaths from smallpox during the year. It is noteworthy that there were but 9 deaths from alcoholism, of which but 3 occurred among Filipinos. There were but 14 suicides, of which but 6 occurred among Filipinos.

INFANT MORTALITY.

A striking feature of the reports of death occurring in the city of Manila and throughout the islands is the high mortality rate of infants under 1 year of age; thus for the past year the total number of deaths reported as occurring in the city, including transients, was 9,394, while the number of deaths occurring under 1 year of age, as already mentioned, was 3,872, or a total mortality for infants representing 41.21 per cent of the total number of deaths for all ages.

For the month of June also the deaths reported from "convulsions of children" alone exceeded the combined mortality for Manila of the following formidable diseases: Asiatic cholera, bubonic plague, small-pox, dysentery, malarial fevers, typhoid fever, and beriberi.

This excessive infant mortality is one common to all tropical countries. In Manila it appears to chiefly depend upon ignorance with respect to the proper care and feeding of young children and the difficulties of obtaining suitable food where nursing by the mother is for any reason impracticable or the supply of breast milk is insufficient. Fresh milk is almost impossible to obtain, and when obtained is usually of poor quality and contaminated by improper handling. In the absence of ice its preservation is practically an impossibility, and no attempt is made to modify its constitution so as to conform more nearly in character to human breast milk. The destructive epidemics of rinderpest have also largely destroyed the few milch cattle formerly in the islands, and there has been but little resort to goats as a source of milk supply. The so-called Australian milk is costly, its use is not general, and it is not well borne by many. The employment of prepared infant foods is understood by but few, and their cost places them beyond the reach of the poorer classes. The same applies to the use of condensed milk, which is at present the most available source of supply of food for infants. When used it is frequently improperly diluted or contaminated by the use of water from an impure source, giving rise to intestinal disorders and malnutrition which are rapidly fatal.

Another chief cause of death among infants is tetanus of the new-born, resulting from infection of the umbilical cord at the time of birth by reason of improper dressing and treatment. One remedy for this condition will be found in a more general employment of physicians and trained midwives for confinement cases, and the care of the new-born infants by measures calculated to prevent such infection.

The prevailing high infant mortality is largely the reason for the relatively sparse population of these islands, which is so in contrast with conditions prevailing in Japan and on the Asiatic mainland. The number of children born to the average family must be considered as large. Filipinos especially appear to be particularly fond of their offspring and anxious for large families, and the shocking waste of infant life is to be entirely attributed to the results of ignorance and the lack of proper food.

It is by reduction of infant mortality that the greatest improvement in the general death rate for the city may be anticipated, and the board of health proposes to do what it can in the future toward lowering this present unduly high proportion of deaths among young children through instruction in the care and feeding of infants, to be given by municipal physicians wherever practicable, and by the issue of printed slips conveying the necessary information in a concise manner. It is scarcely to be hoped, however, that thoroughly satisfactory results can be obtained pending the establishment of dairies furnishing a sufficient quantity of pure milk at a price placing it within the means of the poorer classes.

DEATHS AMONG TRANSIENTS.

During the year there were 502 deaths occurring among transients. The business of the islands practically centering in Manila, this city constantly has a large nonresident population. As the transient population does not enter into the census returns as a part of the permanent population of Manila, the deaths occurring in this floating class are listed separately. The diseases of childhood and old age and those of a chronic character naturally do not figure to any great extent as causes of death among transients, a large proportion of which are males of the working period of life. The most important causes of death were as follows: Beri-beri, 132; Asiatic cholera, 61; pulmonary tuberculosis, 61; dysentery, 23; convulsions of children, 13; plague, 11; organic diseases of the heart, 11.

DEATHS WITHOUT MEDICAL ATTENDANCE.

Out of a total of 9,394 deaths and stillbirths occurring during the year among residents and transients in the city of Manila, 4,541, or 48.3 per cent, are reported to have occurred in the absence of any treatment by a qualified physician. This is to a large extent due to the fact that the poorer classes have but little faith in the efficiency of medicines or physicians, but regard disease as only to be modified by supernatural means. For this reason, and also because it is not well understood that medical treatment can be obtained from the Filipino and Chinese municipal physicians without charge to the indigent, no small part of the population goes without medical care in case of illness or else seeks the advice of ignorant pretenders. In the last stages of disease, when it is evident to all that the patient is in a critical or dying condition, and it is too late to render relief, a physician may sometimes be summoned; but this is apparently more for the purpose of securing his signature to the death certificate, and thereby avoiding trouble relative to procuring burial, than with the expectation of bringing about recovery. The remedy for the existing condition is to educate the people to a better appreciation of the possibilities of modern scientific medical practice, to secure their confidence and disabuse their minds of present suspicions and apprehensions, and to more generally disseminate information as to where medical treatment can be secured without cost to those unable to pay.

BIRTH RATE.

The total number of births reported in the city of Manila during the year was 3,387, giving a rate of 15.39 per thousand on a total population of 219,941. The return of births must be regarded, however, as incomplete and unsatisfactory, and evidently does not represent the total number of births which have occurred in the period mentioned. An improvement in this respect has been noted during the latter months of the year, and it is hoped that reliable statistics of births may be obtainable in the early future.

The total number of births for the year are classified as follows:

Filipinos	3,248
Spaniards	21
Americans	47
All others	71

As the Chinese population is almost wholly composed of adult males, who intermarry largely with Filipinos, the children of mixed blood are usually reported as Filipinos and appear under that heading.

A large part of the American and other white population of the city is unmarried and composed of adult males, and the birth rate among these classes is necessarily small. As conditions have become more settled and the American residents and officials here have been joined by their families and established homes, there has been a gradual increase in the number of births reported as occurring in the white population.

Efforts to secure more reliable statistics of births have been made by requiring all vaccinators to make report of births, but the results are unsatisfactory and incomplete. A further obstacle to securing reliable returns is also found in the fact that among the native population the services of midwives and physicians are not employed in a large proportion of the cases of confinements occurring among the native classes.

INSANITARY HABITS.

An important factor influencing mortality rates in the Philippines is the insanitary habits of a large part of the population. These habits are to a certain extent dependent upon racial customs and the attainment of a lower degree of civilization, but it is no less true that they have relation in considerable degree to conditions of environment. The sovereignty existing in these islands prior to American occupation apparently concerned itself but little with the sanitary welfare of the people, and, while much in the way of reform has been accomplished since 1898, the fact remains that certain permanent improvements essential to the public health have not yet been introduced. As the welfare of the public must be safeguarded by certain restrictions applied to the individual, so the individual has a right to expect that the governing authorities will in turn provide him with certain sanitary conveniences, which he can not obtain for himself, and by means of which he may live in greater comfort, and so that the resulting improvements of his mode of life and surroundings may redound to the general health and well-being of his community. Thus in the city of Manila, in the absence of a pure, abundant, and properly distributed piped water supply, and of a satisfactory system of sewerage and of sewage disposal, it is quite impossible for the poorer classes to conform to modern sanitary requirements, and certain important regulations—as, for instance, the prevention of the pollution of the esteros and the proper disposal of excreta—can not be satisfactorily enforced because of failure by the authorities to provide proper facilities for the disposal of wastes. With the vast amount of work of improvement required to be done about the city, it has naturally been impossible to accomplish everything to be desired during the short time and with the limited funds available since the American occupation; but under present more settled conditions the importance of at once securing certain hygienic essentials should commend itself to immediate attention. It is at present impossible, in the absence of various fundamental sanitary conveniences and necessities, to prevent a number of customs which have a marked influence in increasing the mortality.

It must not be considered, however, that the habits of the people have undergone no improvement during the period of American occu-

pation, for the reverse is quite the case; and especially in Manila there has been a marked change for the better in this respect, as sanitary conditions through the city have been gradually improved. This change has been brought about through the medium of personal example, instruction by government officials, and by the general enforcement of sanitary regulations, a task of late rendered much easier through the apprehension excited by the outbreak of cholera. Even with the gradual relaxation of previously compulsory sanitary requirements, the poorer classes have not wholly returned to previous unhygienic practices, and the value of cleanliness of person and environment and the use of pure water is at present far better appreciated than was the case eighteen months ago. It is obvious that racial habits and customs established by generations of usage can not be immediately done away with, even under the best conditions; but it is possible to gradually modify and improve them, and this has already been accomplished in no small degree. Of course, the best results must be looked for in this respect from education of the younger generation, whose habits are not yet thoroughly established. To this end instruction should be given in all schools with respect to the elementary principles of personal hygiene, house sanitation, and the causes and measures for the prevention of transmissible disease.

PUBLIC BATH HOUSES AND LAUNDRIES.

The establishment of public bath houses and laundries is urgently needed in the city to meet the requirements of that class of the population which at present has no place other than the river and esteros to resort to for bathing and washing clothing. There is no question but that bathing in the polluted waters of such places is the cause of much disease of a gastro-intestinal nature, a fact which has been very evident during the existence of cholera. The frequency with which this disease appeared during the calendar year 1903, among the boatmen, laundresses, and others whose duties brought them in close relation with the waters of the river and esteros, is abundant evidence of the fact that these waters should not be used for bathing or other purposes; nevertheless it may be accepted that they will be continued to be resorted to until the city provides other facilities of better character. The washing of clothing in such water is highly undesirable; garments are frequently washed in this way for hire and are then distributed to customers throughout the city, often among those who otherwise take the greatest care in their own persons for the prevention of disease. Even where the water is not infected with cholera, the parasitic germs of "dhobie itch" and other skin diseases may readily be transmitted in this way. It is therefore recommended that a sufficient number of bath houses, equipped with shower baths and connected with the city water supply, be provided by the authorities, and also a sufficient number of public laundries supplied with clean water, at which work may be safely carried on. If desired, a small fee for the use of such public baths or wash houses might be charged to defray all expenses, but it is believed to be preferable that they should be supported from the municipal funds and that no charge should be made for their use.

These bath houses and laundries need not be of an expensive character in order to satisfactorily fulfill the necessary requirements, but

the installation of some sort of conveniences of this nature is a sanitary necessity. No law looking to the prohibition of bathing or washing clothing or other articles in the river or esteros can be enforced until the city has provided better facilities to take the place of the present insanitary conditions.

WATER SUPPLY.

The matter of the provision and distribution of a pure-water supply for the city of Manila, by the provisions of the municipal charter, is placed outside the province of the board of health and put under the control of the municipal board.

A proper water supply is the most urgent sanitary need of the city at the present time. This supply should be of originally pure character and be secured under conditions which preclude its subsequent contamination by the germs of infectious disease. It should not only be ample in quantity, but should be so distributed throughout the city as to be readily available for use by the entire population. None of these sanitary essentials obtain in Manila at the present time. The water supply is practically the same as was supplied to the city under Spanish rule, and is pumped by four old-style engines into the Deposito reservoir from the Mariquina River at a point some 2 miles below the large town of Mariquina, located immediately on its banks.

The towns of San Mateo and Montalbon are located higher up the stream, and between these three communities the river is practically fringed with native houses. It is estimated that some 20,000 persons at present live on the watershed of the Manila supply, and many of these are so immediately resident along its banks that it is inevitable in rainy weather that the water of the stream should be directly contaminated with surface washings from the ground in the vicinity of their habitations. Further, in Spanish times this large population was accustomed to habitually resort to the river for the purpose of washing clothes and the bathing of their persons and animals, and much foul waste undoubtedly found its way into the stream. Every effort has been made during the past eighteen months to prevent such general contamination, but these efforts have only been partially successful. Although the river has been guarded for miles along its course by outposts of United States infantry, and in addition has been frequently patrolled by cavalry, it is notorious that a thorough quarantine of the Marquina River has not existed. It is unquestionably true that much of the grosser forms of pollution have been prevented by the precautions taken, and that a water-borne epidemic of cholera in Manila has fortunately been avoided, but there has never been a time when sufficient guards could be stationed along the river to keep every portion of it in view at all times, and the cavalry patrol has been easily evaded through lookouts posted to give timely warning of its approach. At night, also, it has been impossible to keep such a lengthy stretch of water efficiently guarded, and it is well known that the river has been resorted to under cover of darkness for bathing and washing.

It must not be forgotten that an abundant supply of water is absolutely essential to the Filipino and to his carabao, and that to be suddenly deprived of such supply has meant great discomfort and hardship. To keep him away from the river for the sake of the population of Manila means a personal sacrifice which the average native has been unwilling to make, even where he can be brought to understand

its importance in relation to the occurrence of cholera in the city. Under existing conditions, therefore, a pure water supply for Manila can only be obtained by one of two alternatives—either the watershed must be depopulated above the intake for the water supply of the city of Manila, or this water supply must be drawn from a new source beyond the likelihood of contamination. The first alternative is impracticable, by reason of the discomfort, financial loss, and discontent which it would cause to thousands of families, and from the large amount of fertile rice land which would be thrown out of cultivation. Fortunately, the second alternative presents engineering problems of no great difficulty and implying no great expense. Before reaching the broad valley of the Mariquina, this stream passes through a narrow canyon, across which a dam can be cheaply constructed and from which an abundance of water can be piped by gravity into a reservoir and over the intervening 14 miles into the city. Above this canyon is a mountainous watershed covered with primitive forest and practically uninhabited, so that the purity of the water from such a source would remain unquestioned.

To run conducting pipe from the proposed dam would not be costly, as it would be laid on the surface and no great engineering difficulties would be encountered. Further, the increased pressure secured would be sufficient to throw water over any building in Manila; while at present much annoyance is created by the fact that at certain times of the day, in various districts, there is not sufficient pressure to raise the water to the second floors of houses. At the present time, also, the maximum supply for all purposes which can be furnished the city, operating all the engines at the pumping station at their maximum capacity, is about 40 gallons per day and per capita, based on the existing estimates of population. This quantity is, of course, quite insufficient to properly meet the municipal needs for domestic and manufacturing purposes, even in the absence of sewerage, and should be tripled to supply the future necessities of the city. As the present reservoir at El Deposito holds but one day's supply for the city, the temporary breaking down of one or more of the old engines now in use might mean a serious shortage of water for the inhabitants of Manila. The distribution of the present water supply is also extremely faulty. Large sections of the city are unsupplied with mains, particularly in the nipa districts. The inhabitants of such districts have thus been required to carry water long distances from the public founts, to dig wells, which inevitably become contaminated, or to resort to the foul esteros for water for domestic purposes. In time of fire, also, there is often no water by which the flames can be brought under control, as the costly conflagrations of the past year have shown. Under such conditions it is scarcely to be expected that proper domestic sanitation would be maintained even with the most intelligent and highly civilized communities, and with its source of water supply lying open to pollution of the gravest character it is inevitable that water-borne disease should be an important cause of sickness and death in the population of Manila.

This insufficiency and impure character of the water supply of Manila has been a cause of much anxiety to the sanitary officials, especially during the existence of cholera in the islands, and no effort has been spared to render contamination of the water less likely to occur. Particularly was this the case toward the end of the past dry season, when

the greater part of the town of Mariquina was destroyed by fire and some 4,000 people suddenly rendered homeless. These homeless people crowded down among the trees which bordered the river, where they erected temporary shelters. They had no sanitary facilities whatever, and contamination of the river was inevitable at a time when the drought had converted the river from above the intake down into a sluggish lagoon, about 60 per cent of the outflow from which was pumped into the water mains of the city. The appearance of a case of cholera among these refugees was all that was required to light up an epidemic in the city, and this disease had already appeared in certain towns in the vicinity. The situation was very grave. To insure a more energetic handling of the conditions the board of health for the Philippine Islands took the control of the Mariquina watershed out of the hands of the provincial health authorities, secured the assignment of a larger number of United States troops as water guard and the detail of a company of constabulary as sanitary police, sent up from Manila a number of American and native sanitary inspectors and a detachment of disinfectors with complete outfit, moved the refugees away from the river and provided them with tents, installed the pail conservancy system in the town of Mariquina to limit soil pollution, and placed the whole sanitary service in charge of an efficient medical officer under the board of health. By these efforts the Mariquina River has been prevented from becoming infected with cholera, and the city of Manila has undoubtedly been spared a grave epidemic.

The great necessity of a better water supply for Manila has forcibly presented itself to the municipal board, and within the past few months surveys have been made and plans are now being prepared for a new and complete system of waterworks deriving an ample and pure supply from the uninhabited watershed already mentioned. It is understood that the work of construction will be commenced at the close of the present rainy season, and that water from the new source of supply will be available within the city about eighteen months subsequently. The important bearing of such an improved supply upon future sanitary conditions in Manila can scarcely be overestimated.

There are a large number of shallow wells in the city, which were largely used as sources of supply in Spanish times. Many of these wells are of very primitive character, being often simple excavations carried down to the level of the ground, water lying but 3 or 4 feet at most below the surface. These wells are frequently without walls, are unprovided with facilities for lifting out their contents, and are very readily contaminated with surface washings from storm water or drippings. Other wells are of better character, are stoned up and are protected against surface washings, but the quality of the ground water contained in all shallow wells is uniformly bad, due to its nearness to the surface and the character and high degree of pollution of the soil. These shallow wells were all closed during the cholera outbreak of 1902, but authority has been granted for the reopening of a few of them for watering animals and for domestic purposes outside of drinking, cooking, and the washing of cooking utensils. Several driven wells have been sunk within the city or in its immediate vicinity, and excellent water obtained in abundance at a depth of 700 to 1,000 feet. With a pure water piped from the upper portion of the Mariquina River, recourse to such driven wells will not, however, be necessary.

During the rainy season much storm water is caught for domestic

purposes. Many of the larger houses and institutions are equipped with rain-water cisterns of large size. These, when kept in a cleanly condition, have not been interfered with. It was noteworthy that during the cholera outbreak those who used only cistern water, as in the large ecclesiastical institutions, were relatively much less liable to be affected with the disease.

The use of boiled water has been repeatedly urged upon the people, by circulars and through the sanitary officials, for drinking and cooking purposes. It can not be said, however, that entirely satisfactory results have been attained in this respect with the Filipinos, many of whom have not facilities for boiling any great quantity of water, and are unwilling or unable to go to additional expense for fuel. The Chinese rarely use raw water, but take it boiled in the form of tea. Distilled and imported bottled waters are largely used by the Americans, and the use of the former by troops is made compulsory by military orders.

Experiments at the government laboratories show that the ordinary tap water may be efficiently sterilized for drinking by the addition of acetozone, 1-30,000.

DRAINAGE.

The removal of storm water from the city of Manila can only be accomplished satisfactorily during the rainy season by means of a proper system of surface drains, which are now largely supplied by the existing network of canals and esteros. It has been proposed to fill up and do away with these esteros and to substitute therefor underground channels for the removal of storm water. This would be a sanitary and economic mistake. The esteros will alone furnish sufficient drainage facilities to adequately remove the storm water resulting from the heavy precipitation of the rainy season, and instead of being filled up they should be enlarged, improved, and somewhat modified, and regarded as a valuable agent in maintaining a good sanitary condition throughout the city. If kept clean they need in no sense be offensive or unsanitary. In case of earthquakes they would not be liable to widespread injury, which might be suffered by an underground system, and to place them in a proper condition would be much less costly than to attempt to substitute any such underground system, which would unquestionably yield much less satisfactory results. Further, these esteros have much value in furnishing ready communication by water to nearly all sections of the city. Any plan looking to the better drainage of the low-lying site occupied by the city of Manila should therefore include the estero system as an essential factor.

SEWERAGE.

Manila may be regarded as an unsewered city, for practically all the few underground channels that exist for the removal of wastes fail totally, from a sanitary standpoint, of accomplishing the purposes for which they were intended. There are a few old underground drains of Spanish construction traversing some of the more densely populated districts of the city, but even the exact location of these is a matter of question, as no sanitary map or information on this subject has been handed down from the previous administration. Where these sewers have been opened up for any reason they have been found to be of

rectangular form in cross section, made of loose slabs of stone between which the liquid contents of the sewer has ready escape into the sub-soil, and laid without regard for proper fall and the avoidance of undue friction. More or less surface water gains access to these drains through the crevices in their top and sides, and they soon become blocked and a source of much offense and annoyance as a result of the sand and mud which gains entrance in this manner. From the level site of Manila and the character and construction of the sewers themselves the flow of sewage through them is very sluggish, and discharge of their contents is only possible on the falling tide. Most of them empty into esteros rather than into the river, and by the pollution of the former they contribute largely to the difficulties encountered by the sanitary authorities. A few of the larger establishments and institutions have private sewers, usually opening directly into an estero, and many of the better class houses are provided with private drains. Nearly all of these, except those of recent construction, are unsanitary and inefficient. To limit the nuisance resulting from their direct discharge into the river or esteros, the sanitary authorities are now requiring the use of an intercepting septic tank to permit of certain purification before final discharge.

The installation of a modern sewerage system through Manila is urgently required at the present time, and this necessity will become even more apparent following the introduction of a more abundant water supply. With greater inflow of water there will be a greater outflow of wastes, and the proper removal of these means additional provisions to that end. The continued existence of privy vaults, cess-pools, and closets discharging over the esteros is not only creative of much nuisance but directly tends to the spread of infectious diseases of a gastro-intestinal nature, as these facilities do not permanently remove the discharges from the possibility of human contact. The pail conservancy system is not without serious sanitary defects, and while it presents much improvement over previously existing conditions, this system should always be regarded as a makeshift and temporary expedient only. In the absence of proper sewerage, the sanitary condition of the city can never be regarded as satisfactory and the public health can not fail to be unfavorably affected thereby to a very great degree. In a country liable to invasion by the infection of cholera from time to time, and in which other serious intestinal diseases are prevalent, it is of the utmost importance that facilities should be provided by which the excretal discharge may at once come under such conditions as will render them innocuous, rapidly and efficiently accomplish their removal from the city, and ultimately dispose of them in such a manner as to destroy their infectious character and prevent their being a cause of disease among the people. A proper system of sewerage and sewage disposal for Manila would undoubtedly cost a large sum of money, not only because of the size of the ground area to be considered but also by reason of the difficulty of securing a satisfactory natural flow by reason of the flat nature of the site upon which Manila is located. Nevertheless, the installation of a sewer system should be regarded as an immediate sanitary necessity and not as a semiluxury which can be indefinitely postponed without serious detriment to the public welfare. As such an improvement would be permanent, the city should be bonded to secure the necessary funds, and the future generations which will also enjoy the advantages of such

improvement should be expected to bear their proper share of the burden of installation.

Without going into any discussion of the engineering problems connected with a sewerage system for Manila, it may be stated that any combined system for the removal of excreta, wastes, and storm water is quite out of the question, and that a separate system for the removal of excreta and liquid wastes only is alone practicable. This is due to the fact that with the unequal distribution of rainfall through the year, and with the tremendous precipitation during the rainy months, no combined system would be satisfactory during both the wet and dry season. No practicable underground system of channels would be at times able to effectively and promptly remove storm water, and such large conduits as would do this work with ordinary rains would be difficult to keep properly flushed and altogether beyond the needs of the city during the dry season. The expense of building such large conduits as would be required for the combined system, which would necessarily be of masonry, would be almost prohibitive; and conduits of this size and character would also be much more liable to injury and destruction by earthquakes, a feature which, in connection with underground channels for Manila, must be given the serious consideration which its importance warrants. It is more than probable that the movement of sewage in conduits located in certain parts of Manila will have to be carried on by pumping engines, and during the rainy season with a combined system such engines would be entirely unable to cope with the situation. Further, some purification of the sewage before its discharge into the river or bay will very probably be necessary, and the difficulties and expense of doing this are always directly increased in proportion to the volume of water in which the solid sewage matters are suspended and by material variation in the daily volume of the flow. Because of the flat nature of the site of the city, it will undoubtedly be necessary to consider the sewerage of the various districts separately, and to regard the system for the whole city as an aggregation of district units. Storm water should be disposed of only by means of surface channels, for which, as already stated, the existing esteros, with certain alterations and improvements, will do admirably.

The advantages of a separate system of sewerage for the removal of excreta and house and manufacturing wastes only are very obvious. The first cost would be only a small fraction of that of larger conduits, as earthenware pipes would answer all purposes, and the size necessary for their efficiency in the removal of wastes at all times could be accurately determined in advance, either from existing conditions in the closely built section of the city or from an estimate of the future size and character of the population in sections not as yet entirely built up. As storm water would not enter into the calculation, the volume of sewage discharge from a district could be told in advance from the volume of water supplied from the proposed new city mains delivering to that district. The volume of sewage being practically a constant quantity, the efficient flushing of the sewer pipes at all times would be assured and the capacity of any pumping engines required could be accurately gauged. With the solids existing in about the same proportion in an approximately constant volume of sewage the difficulties of purification would be materially decreased. Finally, in case of earthquake the liability to injury or destruction of earthenware

sewer pipes would be much less than that of large masonry conduits, and any such injury could be much more quickly and economically remedied.

It is earnestly to be hoped that this question of constructing a sewerage system for the city may be given the immediate attention which its great sanitary importance deserves. The two most imperative needs of the city are a more abundant and purer water supply and a more effective and sanitary means for the removal of wastes. These two improvements are really complementary to each other, and their installations should be carried out at the same time. Both are much needed at the present time and nothing is to be gained—and unquestionably much will be lost—by further delay. As under existing law the board of health acts only as an advisory body in respect to the above matters, its duty necessarily ends in pointing out in a way which can not admit of misinterpretation the prime necessity of making the improvements mentioned; but it can not accomplish the reduction of the death rate of Manila to the degree otherwise possible, unless it is provided with the fundamental sanitary essentials which are everywhere accepted as indispensable in bringing about such a result.

ESTEROS.

The problem of purification and improvement of the canals and esteros ramifying through the city is also one of much sanitary importance. Under the Spanish rule practically all the excreta, garbage, and manufacturing wastes found their way into the esteros, which thus were converted into open-air sewers, the foul and festering contents of which were offensive to sight and smell and a grave menace to the public health. In the absence of any proper sewerage system, these esteros still serve such purpose to a considerable extent, but the situation has been somewhat relieved by the collection and removal of garbage by the municipal authorities, the removal of many of the privies located over the esteros and the installation therefor of conservancy pails removed by the city scavengers, and by the interception by septic tanks of many private drains, so that the discharge from the latter has undergone considerable purification before mixing with the waters of the esteros. This work is being generally extended and will result in further improvement, but conditions are still highly unsatisfactory and will remain so to considerable extent until such time as a general sewerage system has been constructed for the city and existing laws prohibiting the pollution of the esteros can be enforced.

At present much foul matter still finds its way into the esteros, for the simple reason that no more sanitary means of disposal has been as yet provided by the city authorities. To prevent the discharge of manufacturing wastes into the esteros at the present time would result in the practical breaking up of many thriving industries, and to require the removal of all privies built over the esteros, in the absence of suitable provision for the disposal of excreta, would merely result in widespread soil pollution. Of the two evils of soil or estero pollution, the contamination of the esteros is the lesser from a sanitary standpoint, and for this reason the board of health has refrained from general enforcement of the existing laws prohibiting such contamination. During the rainy season these esteros are thoroughly flushed out by the great volume of storm water passing through them, and

their pollution at such time gives rise to relatively little offense or nuisance, as organic matters gaining access to the esteros are soon carried out into the river and bay, and thus effectively removed from the city. During the dry season, however, the conditions are quite different. In the absence of rainfall practically no clean water gains access to the upper portion of the esteros.

The rise and fall of the tides has little purifying effect, as there is no through and through flush and there can be little mixing with the cleaner river water on the rising tide except in the lower portion of the esteros, because of the length, narrowness, and many bends in the latter. As the bottoms of the esteros are never laid bare at low water, the rising tide simply forces the foul water remaining at the ebb tide in the esteros back up into their upper portions on the outskirts of the city. With the falling tide the cleaner water which has been carried in from the river is the first to pass out of the mouths of the esteros, and the filthy water from the upper reaches follows it down into the heart of the city, where it gives rise to foul odors and much annoyance and complaint. About the time that this very foul water begins to escape into the river the tide again turns, and this contaminated water is forced back again up the esteros without having been able to pass out. The volume of outflow and inflow being the same in the absence of rain, there is simply an oscillation of foul water from one portion of the estero to the other, without sufficient purification by discharge or dilution to offset the pollution constantly going on. As a result, when the dry season has well advanced, the estero water has become extremely foul and offensive and its condition becomes progressively worse until the return of the rains. The condition is one urgently requiring remedy. The suggestion frequently made that the esteros be wholly or in part filled up is for several reasons a grave mistake, and founded on a radical misconception of conditions. While contamination of the esteros by sewage and organic wastes should be prevented, they must be regarded as open drains through which all surface waters are to be removed. Further, these esteros are of great economic value, as they afford ready access by water to all parts of the city and enable traffic to be carried on more cheaply than by any methods of land transportation. The esteros should therefore be retained to perform their present important functions, but should be improved and deprived of their existing noxious qualities so as to operate rather for the promotion of healthfulness than the transmission of disease, and to be an ornament to the city instead of a source of offense.

A number of plans have been proposed for the purification of the esteros during the dry season. One such plan calls for the excavation of a canal to take water from the San Juan River and encircle the western half of the city, passing near the San Lazaro Hospital and opening into Estero Bitas. Water from this canal is to be discharged into the heads of the esteros near which it passes. Such a canal as is proposed would cost upward of \$200,000 and much time for its construction, and would then relieve conditions in but half of the city only. A plan has been devised by Dr. E. L. Munson, assistant to the commissioner of public health, by which the esteros of the entire city may be cheaply and efficiently flushed out with each tide. His preliminary report has been approved by the various engineers of the government, and recommendations made to the municipal board that

the system be given preliminary trial in certain esteros. In reply it is stated that the work will be undertaken as soon as possible and that it is hoped that a trial may be had within two or three months. Briefly, the plan suggested by Doctor Munson consists in so controlling the tidal action in the esteros as to cause a constant movement of the water in the esteros toward the lower portion of the Pasig River, with discharge into the same on the ebbing tide, while these esteros fill up during the rising tide with water drawn from relatively clean sources. This is accomplished by outflow gates at or near the mouths of esteros and inflow gates near their heads, preventing any escape of the cleaner water except by traversing and flushing out the esteros on the falling tide and shutting out any entrance into the esteros of the foul water from the river as the tide rises. Three short inflow flushing canals require to be excavated to perfect the operation of the system through the entire city, but the estimate so far given places the total cost of flushing canals and tidal gates at about \$15,000 for the entire city, for the temporary improvement of existing conditions.

The ultimate permanent improvement of the esteros includes the construction of valve gates of more solid construction, to insure proper purifying movement of water through the esteros with each tide. The esteros should be straightened wherever practicable, walled up with stone on the sides to suitable width, and dredged to a uniform depth of 4 feet at low tide so that mud banks may never be exposed. After dredging, the material removed should be used to fill in the low places lying behind the walls, and smooth pathways should be constructed along the side of the esteros to facilitate traffic. The permanent improvement of the esteros will cost much money and will require many years for completion. In the meantime existing conditions demand that some measures be taken for the sanitary improvement of the esteros, and this matter should receive prompt attention from the municipal authorities.

The enactment of a law prohibiting the storage or maintenance of lumber, logs, or bamboo in the waters of the esteros within the city is much needed. At the present time the flow in these esteros is considerably interfered with as a result of the presence of such obstructions.

SUNKEN LANDS.

The sunken and marshy lands within the city limits should receive attention, and a policy looking to their gradual filling in should be inaugurated. These sunken lands are in many instances alternately flooded and uncovered by foul estero water through the action of the tides, and are malodorous and unsanitary. For the purpose of filling any relatively inoffensive refuse may be employed, and such material as ashes from the shipping at the docks, ice plants, crematories, breweries, and large industrial institutions are particularly valuable in this respect. No material which can properly be used for filling should be removed from the city, or dumped into the bay, as it is urgently needed for use in improving the sanitary condition of future building sites. While such materials may amount to relatively little in quantity at any one time, the continued disposal to best advantage of street sweepings and inoffensive wastes resulting from materials constantly being brought into the city can not fail to ultimately materially improve it from a sanitary, economic, and esthetic standpoint. The enactment

of a law penalizing the maintenance of grounds sunken below the neighboring road level, after the expiration of a reasonable term of years, would have the effect of causing owners of such property to take suitable measures for the gradual filling in of their premises in the most economical manner. It is suggested that if such a law subjected sunken lands located in the better part of the city to a slightly higher rate of taxation after the expiration of ten years subsequent to its enactment, it would result in some immediate benefit and be of much permanent advantage for the future. To meet immediate sanitary necessities, it is also highly desirable that a law should be passed prohibiting the erection of permanent buildings until the proposed sites had been filled in to a grade specified by the city engineer, which grade should have such a definite relation to mean high tide as would insure that such building sites would not be overflowed. Attention is invited to the fact that through the enactment at the present time of comprehensive but moderate laws of the above character, the aspect and sanitary condition of the city can be very greatly improved in the course of ten or fifteen years without the imposition of undue expense or annoyance upon property owners.

MOSQUITOES.

The sunken lands and esteros of the city serve as congenial breeding places for countless mosquitoes. These insects are fortunately, to a large extent, of a species which does not transmit the infection of malaria, but the full possibilities of mosquitoes as carriers of disease have not as yet been thoroughly determined, and under present conditions they are certainly a cause of much annoyance and discomfort. The improvement and regular flushing out of the esteros, the installation of a sewerage system, and the filling in of the sunken lands will largely relieve the city of their presence.

In connection with the mosquito question mention should be made of the fact that the species of mosquito common in Manila and along the low-lying coast lands is the *Stegomyia* variety, proved by the board of army medical officers in Cuba to be the only agent in the transmission of yellow fever. The yellow-fever infection has not been introduced into these islands, but should this once occur here there is no question but that this disease would become as severe in these islands as in the West Indies, Brazil, and other places where it has long been endemo-epidemic, and local conditions are such that it could be controlled only with great difficulty. The reasons why the disease has not yet appeared here are that human beings sick with yellow fever can transmit the disease for but a few days only, and that while mosquitoes infected with yellow fever may live several months, they could not survive a passage from the West Indies or Brazil around Cape Horn, and would hardly be liable to maintain an existence during a prolonged sea voyage on a sailing vessel from the yellow-fever-infected ports on the west coast of the American continents. Further, there has been very little direct trade between such ports and the Orient. With the projected cutting through of an isthmian canal the entire sanitary situation will be changed as regards the possible outbreak of yellow fever in these islands, as they will then come into direct communication with the yellow-fever districts of the West Indies, Mexico, and Central America, by numerous swift steamers making the run within

a few weeks, or well within the usual period of life of the yellow-fever mosquito. Under such altered conditions the mosquito question in the Philippine Islands will give rise to sanitary problems of an importance which can not be overestimated, and the only safety for these islands and the tropical Orient generally will lie in the fumigation of every vessel which has passed through the projected canal and before it is allowed to proceed to its destination.

STREET CLEANING.

Although the work of street cleaning is not performed by this department its influence upon the public health is such as necessarily to require brief mention in a report of this character. There has been great improvement in respect to the cleanliness of the streets and public ways of the city since the days of Spanish control, when the work was let to private contractors whose facilities and employees were not of such character as to secure efficient results. The street-cleaning service at that time consisted of carabao carts which went through the streets, each accompanied by one or more sweepers. The latter were of such kind as could be hired at the lowest wages and largely consisted of a class of individuals who were unable to perform heavy labor or secure more remunerative employment. There was no attempt at organizing the street sweepers into a permanent and efficient force or to subject their work to proper inspection or to district the city for such work or provide suitable implements and transportation facilities. Under American control the public ways of the city have been cleaned up, repaired and maintained in a condition of cleanliness which would reflect credit on any community of equal size anywhere, and these great improvements have unquestionably been of much assistance to the sanitary authorities in reducing the death rate in the city.

COLLECTION AND DISPOSAL OF GARBAGE AND REFUSE.

Work of this character is performed by the department of streets and parks under the direction of the city engineer; but the sanitary inspectors of the board of health take cognizance of any failure to remove refuse from premises which they may inspect, and report the same to the superintendent of streets and parks through this office. It is required that garbage be placed in water-tight metal containers of suitable size and construction, and these, together with receptacles for other refuse, must be set out for collection at the out curb of the sidewalk in front of the premises not earlier than 9.30 p. m. or later than 5 a. m., and is removed in sanitary carts. This system of removal works excellently, the service appears to be effective, and there is little complaint on the part of the house holders as to the way in which it is carried out. The garbage is taken to a crematory, where it is sorted and destroyed. Material like stable refuse, banana stalks, and vegetation has heretofore been taken out into the bay and dumped, but this method of disposal has lately been abandoned.

COLLECTION AND DISPOSAL OF HUMAN EXCRETA.

This by law is placed under the direction and supervision of the board of health. The work is partly performed by the employees of

the pail conservancy system and partly by private contractors, of whom 13 are at present authorized. It is efficiently carried out by the former, but much less satisfactorily by the latter, whom it is difficult to keep under proper supervision. In Spanish times all work of this sort was performed by private parties under contract. The receptacles of the pail conservancy system are, of course, looked after by the employees of that department. Vaults and latrines are emptied only at night. The pail conservancy system uses odorless excavators for this purpose, but the private scavengers are not equipped with such apparatus and still use the unsanitary method of emptying the vaults by hand or by the bucket system, the excreta being placed in tight carts or barrels for removal. Such material is then taken out into the bay, where it is dumped outside of certain specified limits. There is much reason to believe that the agents of certain of the private contractors do not always do this, but at times take advantage of the darkness under the bridges to dump the cargoes of their craft into the esteros or river, with the creation of much nuisance. Any system delegating such important sanitary work to private parties will always be imperfect, but the board of health is not authorized to exclude private scavengers, nor is it so equipped at present as to be able to properly assume the responsibility for entirely carrying on such work throughout the city.

The facilities for the immediate disposal of excreta in the city are of divers kinds. A few modern flush water-closets, discharging into septic tank installations, have been placed in some of the better class houses since American control. A number of other buildings are fitted with old water-closet of obsolete and unsanitary pattern, discharging into cesspools or esteros. In other houses leaching or cemented privy vaults are installed, with latrine seats on one or more floors and connecting with the vault by straight or slanting shafts. In habitations near esteros a loose platform or overhanging privy may be built over the water, while in the outskirts of the city shelters over excavations or even the open fields are used. To remedy the most unsanitary of these methods of disposal, the pail conservancy system was put into operation on July 1, 1902, and its field of application has been gradually extended as time and opportunity has permitted.

PAIL CONSERVANCY SYSTEM.

The operation of the pail conservancy system may be regarded, on the whole, as being satisfactory as a temporary measure of relief. While there is little complaint with reference to the working of the system from Americans, Spaniards, and the more intelligent Filipinos, the lower classes sometimes fail to use the buckets properly and to maintain due neatness, and as a result a few complaints have been rendered as to the unsatisfactory operation of the system. Experience has shown that in making provision for the disposal of the excreta of the poorer classes by the pail conservancy system it is frequently preferable from a sanitary standpoint not to make installations of individual pails in separate houses, but to group the pails for a number of houses in a latrine open to the general public. In a public latrine the pails can be properly looked after and kept in good sanitary condition by the attendant constantly on duty, and much time and labor is saved by thus doing away with the necessity of collecting and distributing

sanitary pails over wide areas. Of course, the cost of operation of any such public latrines must be defrayed from the public treasury, and the income of the pail conservancy system will be proportionately reduced, but it is believed that the increased efficiency of the system will more than recompense for the greater expense to the authorities. Attention is invited in this connection to the appended statistical table and the reports of the superintendent upon the operation of the pail conservancy system in Manila and in the Mariquina Valley.

The new scavenger barge *Pluto*, which will serve as a dumping boat in connection with the pail conservancy system, was received from the builders in Shanghai by the board of health during the month of August. She is a craft of 285 tons burden, and is well suited to the purpose for which she is intended. As the draft of this vessel is 8 feet, it will be necessary to make permanent arrangements for her accommodation at some point in the Pasig River, where she may be reasonably accessible and can take on cargo without giving rise to undue offense. For reasons of economy, it would be highly desirable if the central station of the pail conservancy system and dock of the scavenger barge could be close together. With the present congested condition of the river, and the way in which it is built up along its bank, it is a matter of some difficulty to satisfy the above requirements. The best and most available place appears to be outside the city wall, on the south bank of the Pasig, near where the wall is now being breached and where there is space for the necessary plant. The *Pluto* will receive all night soil in process of removal by both public and private scavengers, as well as the material resulting from the operation of the pail conservancy system, which will then be conveyed out to sea daily and dumped under such conditions as will prevent any possible occurrence of nuisance.

The work of the pail conservancy system was carried on from July 1, 1902, to August 1, 1903, by Mr. B. H. Burrell, superintendent, who was relieved on the latter date to take a position in the provinces by Maj. G. M. Barbour, who was for four years in charge of the street cleaning department of Santiago, Cuba.

HABITATIONS.

These in the city of Manila are of three main types, and from their difference in construction they exert by no means the same influence upon the public health.

The ordinary Filipino house is elevated several feet above the ground on bamboo posts, with floors of bamboo slats, roofs of nipa thatch, and walls of nipa or of suale wickerwork. These houses are cool, dry, and well ventilated, and when located on a suitable site, with plenty of air space, provided with suitable facilities for the disposal of excreta, and kept in cleanly condition as to their surroundings, they must be regarded as a very hygienic type of dwelling for this climate. Unfortunately the above sanitary requirements are not usually satisfied. The buildings are highly inflammable also, and when such houses are located close together and fire occurs in one during a high wind during the dry season it is impossible to prevent the devastation of wide areas. Thus by the fire which occurred in the Santa Cruz district during the month of May some 15,000 people were, in less than two hours, rendered homeless.

The second class of house is of heavy masonry construction, and of the type built by the Spaniards many years ago to withstand time, fire, and earthquake. These may be regarded, as a class, as highly unsanitary. They are dark and unventilated, are without sanitary conveniences, and furnish convenient retreats for vermin. In some of them the ground floors, used as habitations, are below the street level; these floors are ordinarily of dirt, but are now being replaced by cement as rapidly as practicable. Where these houses are used as habitations they are usually occupied by Chinese or the lowest class of Filipinos and are much overcrowded. They are built close together and in such a manner that it is frequently hardly possible to place them in thoroughly satisfactory condition by any reasonable expenditure. While statistics on this point are not available, there is no question but that this type of house exerts an unfavorable influence upon the public health. A large proportion of the plague cases develop therein, and conditions are such that tuberculosis and other diseases among the inmates must be materially favored. More light and air should be let into these houses, their ground floors should be cemented, and sanitary conveniences installed. The enactment of such laws as would require that each room shall have direct communication with the open air, prescribe the minimum window space of each room in relation to the floor space, and prohibits the erection or maintenance of any partitions by which proper ventilation would be interfered with, would be very desirable. Such laws are particularly necessary in connection with the sanitation of houses occupied by Chinese, as this class appears to have a racial dislike to the admission of fresh air and sunlight into their habitations.

The best type of house, used by those in good circumstances, is built of wood, is surrounded by porches, is provided with abundance of fresh air and sunlight, and does not usually have its ground floor used for living purposes. Such houses are ordinarily provided with proper conveniences, are not overcrowded, are maintained in a cleanly condition, and must be regarded as sanitary habitations.

OVERCROWDING.

Among the factors unfavorably affecting the health conditions of the city, the matter of overcrowding is one of the most important. This exists in a dual sense, not only as overcrowding within buildings, but in the packing together of the buildings within the city on a too restricted area.

This too great crowding together of buildings is the direct result of present totally inadequate means of transportation about the city, it being necessary for the poorer classes, whose means are insufficient for the keeping of a horse and carriage or a daily expenditure for carriage hire, to live within a reasonable distance of the place of their employment. In this climate the performance of a fair day's work at heavy labor, in addition to the fatigue of walking any long distance to and fro from the place of employment, is not practicable, and in meeting this demand for house space near the center of the city the owners of ground have permitted the latter to be built up far more closely than is compatible with the interests of the public health and with a greatly increased danger of widely destructive conflagrations. At present little can be done to remedy this condition, as rents are high and the

number of houses in the city is not sufficient to properly shelter the population. An early improvement may be expected, however, when the electric street-car system, the franchise for which has been granted and the work on which has been inaugurated, shall have been completed. This street-car system, extending to every portion of the city, will render life in the suburbs much more comfortable and economical for the poorer classes, and will enable them to be reached in a few minutes from any part of the city. As soon as this street-car system is finished the work of gradually removing the more unsanitary habitations from the too congested districts should be begun, and rational sanitary requirements as to reasonable amount of building space insisted upon. At present with inflammable and unsanitary buildings packed together as they are in some districts, there is every facility at hand for widespread destruction of property by fire and the transmission of infectious epidemic diseases from house to house.

Overcrowding within habitations assumes a somewhat different sanitary importance, according as this overcrowding occurs in Filipino houses of loose construction and light materials or in the buildings of solid masonry erected according to Spanish ideas. As the former type of house is built well above the ground on bamboo posts, and there is always ample movement of air currents through the open spaces in the walls and bamboo floor, these houses are ventilated to such an extent that the inmates are practically in the open air. Fortunately, also, these native houses are small and capable of containing relatively few persons, and there is no opportunity to transform them into the barrack type of tenement building seen in low-class houses of solid materials. Overcrowding in these native bamboo and nipa houses affords opportunity for the transmission of communicable disease from one individual to another, but there is not present the influence of foul air, highly contaminated with human impurities, by which the vital resistance of the inmates of a more solidly built house is slowly overcome, and they are thus predisposed to acquire more readily any infectious diseases with the germs of which they may come in contact. Further, the well-aired native house is less liable to harbor the germs of infectious disease, as these are constantly exposed to destruction by dessicating air currents and sun light, and to removal from the habitation by falling through the spaces between the bamboo slats of the floor to the ground below. In houses of this type the matter of cubic air space has no sanitary importance, and the establishment of a minimum per capita floor space would be all that is required, thus permitting no excessive number of persons to crowd together, limiting the spread of infectious disease should it break out among them and rendering its transmission to the small domestic groups in other houses less liable to occur.

Conditions quite different from the above obtain in the buildings of solid construction, particularly those of masonry, occupied by the poorer classes, and especially by the Chinese. In these buildings, which are frequently large, the floors of the basement rooms are usually of dirt, and are foul and damp. Many of the rooms in such houses have no communication directly with the outer air, and can only receive light and ventilation through a door leading into an exterior room. Rooms which are insufficiently lighted are almost invariably found to be uncleanly, and in the presence of darkness, moisture, organic matter, and stagnant air, the germs of the infec-

tious diseases to be combated in Manila find conditions most favorable for their existence and development. As this class of houses is located chiefly in the more densely populated districts where rents are high, the Filipino tenants are practically forced by financial necessity to crowd into dark, damp, and unventilated rooms of a capacity totally inadequate for their numbers. This state of things is highly undesirable, but the lessening of the condition of overcrowding is scarcely practicable until the electric street-car system renders the cheaper rents of more sanitary houses in the suburbs available for the laboring classes, when the conditions may be expected to improve to a considerable extent among the Filipinos as a result of a rapid transit which must have a marked influence upon the local laws of supply and demand. The Chinese, however, who particularly resort to these unsanitary buildings of solid construction appear to have an instinctive tendency toward overcrowding, and to render the latter even more potent in its evil effects by carefully closing in, particularly at night when the greatest number of persons are present, even the few existing apertures by which ventilation might otherwise be partially accomplished. Without sanitary regulation, such would in many cases crowd together under conditions rendering their habitations literally plague spots. Improved transportation facilities will have no effect upon the mode of life of this class of the population, and hence the minimum permissible floor space and cubic air space per capita should be strictly defined by law to prevent the evils of overcrowding. The use of mezzanine floors and cubicles, as increasing the liability to overcrowding and intensifying the effects of this condition, should be strictly prohibited for sleeping purposes.

INTERIORS.

No inconsiderable part of the population of Manila lives in houses which have no frontage on any street or public way and which are not apparent to the casual passer-by. These houses readily fall into an unsanitary condition unless subject to frequent inspection, and it frequently happens that the very worst specimens of these interior habitations are located immediately behind buildings of good character and cleanly condition which are occupied by a relatively high-grade class of tenants. These interior houses are usually constructed of highly inflammable materials in a state of more or less decay, and are packed closely together. From the material of their construction, their close relation to each other, and their occupancy of ground that should not be built upon, the difficulty of maintaining them and their surroundings in a fairly sanitary condition, and the character of the class that occupies them, they are a cause of much perplexity on the part of the sanitary authorities. These interior houses may practically be regarded as relics of past public neglect to provide such transportation facilities as would permit the poorer population to spread out over a wider area, and of unrestricted private greed which has taken advantage of the necessities of the people even to the point of creating conditions which are a menace to the public health. An essential factor in the future improvement of the city lies in the removal of these unsanitary interiors. This should be done gradually, so as not to unduly inconvenience the population of these interiors, and subsequent to the inauguration of the general street-car system. As the life of

these interior houses is usually of but a few years, they should be condemned and removed as fast as they fall into decay, and rebuilding should be prohibited except under such special conditions as will admit of the carrying out of all sanitary requirements. The removal of these interior habitations will do much to remedy the present congestion of population in certain districts and do away with what must be regarded as highly important agents in raising the death rate of the city.

BOAT POPULATION.

Questions of much sanitary importance are raised by the residence of a large portion of the population of the city, aggregating some 15,000 souls, upon cascoes, lorchas, launches, and other small vessels plying in the river, esteros, lake, and along the water front. These people—men, women, and children—permanently live on the boats upon which they are employed, and are with difficulty kept under proper sanitary supervision by reason of the constant movement of the water craft upon which they are resident. The pollution of the river and esteros by this floating population, by excrement and refuse thrown therein, is impossible of prevention, nor can these people be wholly restrained from using such polluted waters for purposes of drinking, cooking, laundering, and bathing. A sufficient supply of good water for such purposes is never maintained aboard these boats, and even where an honest effort might be made by some individuals to secure good water for drinking and cooking, it frequently happens that the casco or lorcha is made to seek temporary anchorage at parts of the water front and river where water from the city supply is practically unobtainable by reason of the great distance to the nearest pipe line or public fount. Under such conditions, if cholera occurs on board these water craft and the river becomes infected, it is impossible that the disease should not prevail among this class to a far greater extent than among the rest of the city population. This has been true to a large extent of the cases that have occurred during the present calendar year, when repeated bacteriological tests have showed the sluggish reaches of the river to be infected with cholera; although at the same time the numerous water craft of the quartermaster's department of the army, which were required to procure and maintain a sufficient supply of distilled water from the military distilling plants, had practically no cases of cholera develop on board, though they were otherwise under the same conditions. Not only is this casco and boat population difficult to keep under sanitary control, but it is composed of a less intelligent class of people which chafes under any restrictions and evades them where practicable. Although contacts from cholera are no longer placed under quarantine and the precautions usually taken consist merely of the removal of the sick and the disinfection of the boat, the latter operation is so distasteful to this boat population that the sick are often hurried to some place ashore where they are later found by the inspectors; or if such removal was impracticable before the patient died, the body has been in many instances disposed of by being weighted and thrown into the river at night, a procedure which, among a people imbued with the religious belief of the importance of burial in consecrated soil, shows their repugnance to even the simple sanitary precautions required. Whether the sick person was found on shore or the body was removed from the

river, in but few instances was it possible to ascertain the boat upon which the case of disease developed, and thus the sanitary authorities have been unable to seek it out and destroy any infection aboard. Clearly the sanitary questions raised by the existence of this boat population are not readily to be solved. To require its removal to the shore for residence would be impracticable, and to send the boats out into the bay for anchorage when not actually in use would be productive of much hardship, financial loss, and in the case of sudden storm, serious disaster. An important step in advance would be the erection of public latrines ashore, close to the usual points of moorage, and to require their use. While this regulation would undoubtedly be broken at night, it could be enforced during the daytime and thus a large part of the water contamination prevented. An even more important sanitary step would be the piping of the city water supply to numerous places on the river front, where public fountains would permit the boat population to readily procure a supply of pure water. It is easy to deplore the general use of river water by this class of population, but until some other source of supply is provided them, they have no other recourse. This matter is of such importance that it should receive early attention.

During the year much valuable sanitary work has been carried out in relation to water craft lying in the river and harbor, and a launch has been maintained by the board of health to facilitate its performance. This duty has been of a particularly arduous nature during the existence of cholera, as with the infection of the river and esteros a large proportion of the cases of this disease developed along the water front. In the river and harbor work, much valuable assistance has been rendered this department by the Marine-Hospital Service and by the sanitary inspectors of the army, the latter looking after the steamers, launches, cascos, and lorchas operated by the quartermaster's department.

MARKETS AND FOOD TIENDAS.

The public markets of Manila are in general of admirable construction and arrangement and are kept in excellent sanitary condition. Removing as they did the highly unsanitary conditions existing under the previous sovereignty, their erection and operation has been one of the chief factors in the sanitary regeneration of the city. The small market in Sampaloc still remains, however, in much the same condition as during the Spanish times, but it is understood that it will soon be removed to larger and better constructed quarters on a more suitable and spacious site in the vicinity of its present location. It can not be kept in a sanitary condition under existing circumstances. The character and quality of the food brought into the public markets is subjected to thorough inspection, and it is displayed and sold under cleanly conditions. These sanitary markets have unquestionably been a potent factor in limiting the spread of cholera in the city.

The small tiendas, or shops, in which food is sold fill an important place in the municipal economy, as a large number of the poorer people habitually take their meals in these places and do no cooking in their houses, while others send out and buy cooked foods to supplement the meals prepared at home. These food tiendas, of which there are about 1,100 in the city, have been greatly improved in a sanitary way as a result of vigorous inspection and of the disapproval of appli-

cations for renewal of license for the worst class of these establishments, but their sanitary condition as a whole must be regarded as still unsatisfactory. Their present unnecessarily large numbers should be reduced to the minimum compatible with the interests of the class which patronize them, and this smaller number of tiendas should be made thoroughly sanitary by their owners as an essential condition of the latter being allowed to continue in the business of selling foods. This plan is now being pursued, but local conditions are such that progress must necessarily be slow to avoid too greatly interfering with the interests and comfort of the people, and the elimination of the worst class of tiendas can be accomplished only as such places of the better sort increase their facilities and accommodations. In this matter, as in various others in these islands, many considerations intervene to prevent the immediate carrying out of sanitary improvements of a radical character, but they must be introduced gradually to permit the people to adjust themselves to new conditions without being too much inconvenienced thereby. Sanitary work is not looked upon in any city with favor by the very class of the population which most requires to be kept under such supervision. Through passive opposition or evasion of sanitary regulations this class is able to largely neutralize any efforts of the health authorities, and the best results can be obtained only by the avoidance of exciting any too great discontent and antagonism. If this voluntary support can not be gained, at least the exciting of opposition should be avoided as far as possible, and it has been found in the sanitary work here that the best results can be secured by not attempting the immediate attainment of a particular ideal, but by exciting gentle but firm pressure along the whole line.

FOODS AND DRINKS.

The inspection of foods and drinks and of establishments for the preparation and sale of the same is included in the duties of the board of health. This work has necessarily been very onerous as a result of the existence of cholera. Particular attention has been required to be paid with respect to the cleanly preparation and service of foods in the many small tiendas to which a considerable portion of the poorer class of the population habitually resorts for meals; and it was necessary to keep close watch of the markets to prevent contamination of food by handling and flies, and to prevent the sale of articles of food on the prohibited list. The indiscriminate handling of food appears to be a characteristic trait of the lower class of Filipinos, and unless there is some restraint an article of food exposed for sale will be handled by many persons—often with unclean or infected hands—before coming into the possession of the final purchaser. The infection of cholera has been undoubtedly transmitted in this manner in many instances, and the board of health early prohibited such handling of food and required the vendors of foods to supply forks for the use of possible purchasers. As a large number of flies were found to be infected with cholera bacilli during the progress of the epidemic, the protection against flies, by mosquito net or fly screens, of all food exposed for sale was required. The list of foods the sale of which has been prohibited from time to time during the existence of cholera has consisted of some forty articles. These articles included practically

all fruits which are not of acid character and are habitually eaten raw and unpeeled, all salad vegetables, all mollusks, and a considerable number of mixed foods used by the Chinese and Filipinos, into the composition of which certain prohibited articles of food enter or during the preparation of which infection was liable to occur. It was found impracticable to increase the list of prohibited foods to the extent theoretically desirable, by reason of the excessive hardship which would thereby be imposed upon the poorer classes. Even the prohibition of the sale of the foods finally excluded from the markets was productive of discomfort and additional expense, as certain food stuffs, largely entering into the native dietary, were placed under the ban and the price of the permissible foods was increased by reason of the increased demand therefor. During the progress of the epidemic a large number of samples of foods were found at the government laboratories to be infected with cholera.

Additional laws are needed to specifically govern the sanitary management of bakeries and other places in which food is prepared.

There is a large sale of aerated waters in Manila and among the white residents throughout the islands. It is required by city ordinance that in the manufacture of such waters all water used shall be rain or aqueduct water, either distilled or boiled and filtered. The alternatives offered by this law rendered the enforcement of its provisions a matter of much difficulty, as there is no means short of a chemical and bacteriological examination of each water sample of determining the actual purity of water used by establishments unprovided with distilling apparatus. As a result, ordinary supervision and care does not suffice for the proper safeguarding of the bottled water industry; the alternatives of the existing law are used by the unscrupulous to hide their dishonesty, and there is no question but that impure bottled waters appear on the market. The enactment of a law prohibiting the use of water other than that which has been distilled, or obtained from a natural spring approved by the board of health, is very necessary. This would force practically all manufacturers of aerated waters to install distilling apparatus on their premises and to operate the same, and under such conditions the pure water thus distilled would unquestionably be used.

As there is but little fresh milk available in Manila the sanitary regulation of the methods of the production, handling, and sale of milk does not assume the relative importance attained in cities of the United States. This lack of a supply of fresh milk sufficient for the nourishment of infants and the feeding of the sick unquestionably has no small influence upon the mortality rates in Manila and through the islands. Where infants of white parentage can not be nourished at the breast they are perforce placed on a diet of prepared foods which is not always well borne; and in dysentery, typhoid fever, and other diseases a milk diet is an essential of modern medical treatment, for which no prepared substitute is satisfactory. It is much to be hoped that a sufficiently large number of hygienically conducted dairy farms may be established to supply at least sufficient fresh milk to meet the most urgent medical needs. It would seem that capital invested in such establishments located near Manila would be assured of ample financial returns.

The sale of lemonades and other iced drinks by itinerant street

vendors is unquestionably a factor in elevating the sick rates, as such persons can not be kept under efficient sanitary supervision, and may draw their water supply from highly impure sources. During the cholera epidemic of 1902 the vending on the streets of articles of food and drink was prohibited, but this restriction was removed at the close of the outbreak in compliance with popular request. This question should practically settle itself, from a sanitary standpoint, with the introduction of a piped water supply of pure character generally distributed through the city, when it will be easier for such vendors to obtain pure water than to obtain their supply from sources of bad character. The handling of ice by vendors of cold drinks is not always done in a sanitary manner. Fortunately, it is customary for them to leave the block of ice exposed to the air and to shave off the amount required from time to time. As this ice is manufactured from distilled water, the constant melting probably suffices to flush off any impurities which may have been deposited on the surfaces of the ice cake.

OFFENSIVE TRADES.

The question of the restriction and control of offensive and dangerous trades is one of far-reaching sanitary importance for the city of Manila. The present law prohibits the establishment of any new business of a highly offensive or dangerous nature within the city limits, or of less offensive trades within the district of strong materials, or the maintenance of any such business not conducted in a sanitary manner. In the absence of proper sewerage facilities, the wastes from such establishments as breweries, tanneries, dyehouses, etc., existing in the city necessarily drain into the esteros, and largely contribute to their pollution and offensive condition. Even the establishments of this character located outside the district of strong materials discharge their wastes largely into the heads of esteros, with the waters of which they are conveyed into the heart of the city and become a cause of great nuisance, thus practically nullifying the sanitary advantage of removing such establishments from the more densely populated sections of the city. The situation can only be satisfactorily dealt with by the enactment of a law prohibiting the future location of any establishment for the conduction of a more or less offensive trade at any point within the corporate limits of the city or upon any estero the waters of which flow within the city limits, and requiring also that all establishments now in operation for the conduction of offensive trades located within the city limits, or discharging wastes into an estero flowing therein, shall be removed within five years, or such period as may appear to be reasonable. The early enactment of such a law will ultimately result in less interference with business interests, as new establishments of the above sort are, from time to time, being put into operation in localities from which there is no question but that the sanitation of the city will require that they must ultimately be removed.

A law prohibiting the occupancy, for kitchen and dormitory purposes, of buildings in which offensive trades are conducted is also much needed. At present a large part of the workmen engaged in offensive trades, particularly Chinese workmen, live, eat, and sleep in such buildings among highly unhealthful surroundings. No person

should be allowed to remain at night in buildings used for such purposes except watchmen and such individuals as may be actually engaged at the time in legitimately carrying on the work of the business or trade.

OPIMUM-SMOKING ESTABLISHMENTS.

On August 1 there were 190 establishments for the smoking of opium in the city of Manila. These places, from the nature of the business conducted therein and the character of their patrons, are naturally difficult to keep in good sanitary condition. As there is no authority in law for the conduct of such establishments, and as they are consequently not required to take out licenses, the sanitary authorities are thus deprived of a potent aid in keeping them clean and in a condition not prejudicial to the public health. In the case of classes of business such as the keeping of restaurants, market stores, wine shops, etc., which do not as directly affect the public welfare, pressure can be exerted through the withholding or nonrenewal of licenses, by which the carrying out of necessary sanitary improvements is insured of the proprietors; but such means of compulsion can not be brought to bear in the case of opium-smoking divans. If such establishments are allowed to be maintained, it is evident that they should be so supervised and controlled as to have their evil effects upon the public health reduced to the minimum. The existence of such establishments, from every view, is greatly to be deplored. Nevertheless, they do exist, and because of this fact it would seem to be the part of wisdom that their actual existence should not be ignored from reasons of sentiment, but that they be dealt with in such practical manner that their gradual disappearance may ultimately be accomplished.

The habitual use of opium by any individual, class, or race is unquestionably an evil. Whether its ill effects are so manifest among the Chinese as among other nationalities, and how this evil may best be reduced, are questions which the committee, of which the commissioner of public health is chairman, is now engaged in visiting various Asiatic countries for the purpose of investigating. It does not appear that as yet the vice of opium smoking has gained any foothold among the Filipinos, but in these islands it seems to be practically limited to Chinese.

NEED FOR GENERAL HOSPITAL.

There is much need in Manila for a general hospital which shall receive patients not affected with contagious disease, irrespective of nationality. While the army and civil hospitals are well equipped for the treatment of disease occurring in certain restricted classes of the population, and while the hospital of San Juan de Dios is doing an excellent work, these by no means meet the need for increased hospital facilities. This situation was recognized several years ago and an attempt made to remedy the deficiencies by the establishment of the Cosmopolitan Hospital, but work on the construction of the institution has never been completed, and the unfinished building has lately been purchased by the municipal board for use of an office building. The great need for a general hospital is very apparent. An agitation on the subject by a committee of which Bishop Brent is chairman has resulted in the

selection and setting aside of a hospital site on the exposition grounds and an expression from the Philippine Commission of its purpose to construct and maintain such an institution.

SAN LAZARO HOSPITAL.

During the year the several departments of the board of health at San Lazaro have been consolidated under one head. Through the efficient management of the physician in charge the hospital has been improved in its several departments in many ways. Attention is invited to the report of the physician in charge, hereto appended.

MATERNITY AND WOMEN'S HOSPITALS.

During the year these two excellent institutions for the relief of suffering have been closed.

The Maternity Hospital (Asilo de Maternidad) was an institution dating from Spanish times and supported largely by the charitably disposed among the Spaniards and Filipinos. With the return of a large proportion of the former class to the home country and the financial stringency which has prevailed in the islands for several years, it was found impossible during the year to raise sufficient funds to meet the necessary operating expenses. It is unfortunate that this institution has necessarily been closed, as a maternity hospital available for the poorer classes is much needed in the city.

The Women's Hospital was established by the Americans several years ago. With the decrease in the American population of the city the same causes as are mentioned above have operated to bring about its closure. Much of the class of work formerly performed at this hospital is now done at the civil hospital.

HOSPITALS FOR THE INSANE.

There is very great need of proper institutions for the care of the insane in Manila and through the islands generally. The provinces are entirely unprovided with any facilities for this purpose. In Manila the Hospicio de San José, operated by the Catholic Church, accommodates some 300 patients, but this institution is much overcrowded at the present time, and is totally inadequate to meet local needs. At the Chinese hospital there are several small rooms in a detached building which are used for the confinement of the insane, pending the time when they may be returned to China, as is frequently done. There are no other facilities for the care of the insane in the city except a ward at the First Reserve Hospital, where the unfortunates of this class from the Army receive attention until such time as they can be returned to the United States. The mentally deranged among the Filipinos through the islands are thus perforce practically cared for in the houses of their relatives or friends, or in the provincial jails, an arrangement highly undesirable for all concerned. It not infrequently happens that appeals are made to this office to take charge of insane persons, such as transients, the friendless, or those whose mental condition is of such a nature as to render them a menace to the community. In the case of such persons the only available measure

for their safe-keeping seems to be the one which has been adopted—the insane person is charged with disorderly conduct or assault, sent before the police court, and incarcerated in Bilibid Prison by order of the justice. On August 14 there were thus 26 insane being cared for at Bilibid, of which number 19 were sent there by reason of there being no other place available for their reception. This method of procedure is highly to be deplored, and the attention of the authorities is earnestly invited to the urgent necessity of providing, as soon as possible, such adequate hospital facilities for the insane that this method of their disposal may be avoided in Manila, and that some adequate provision for the care of the insane in the provinces may be made.

INFECTIOUS DISEASE HOSPITALS.

During the year there has been very great improvement in respect to the facilities for the treatment of cases of infectious disease occurring in the city. At the contagious disease hospital for the Chinese the buildings in use up to the present calendar year were nipa structures, with loose wooden floors, dark, poorly ventilated, and practically impossible of disinfection. Through the public spirit and generosity of the Chinese merchants funds were raised by private subscription among them for the construction of a pavilion hospital for plague cases—well built, conveniently planned, and of modern type—together with a smaller building to be used as a reception ward. These buildings have been erected and in use for the past three months. The ultimate plan for the Chinese contagious disease hospital includes separate ward units for the treatment of plague, cholera, and small-pox cases under one management. Funds have already been subscribed largely in excess of the cost of the buildings erected, and it is proposed that additional new buildings will be put up as the old buildings are abandoned and the need for better becomes apparent.

The contagious disease hospitals at San Lazaro have been conducted in buildings unsuited for such purposes, and so located as by no means to afford the necessary isolation. Shortly before the Trozo fire the cholera cases received treatment in the nipa and bamboo buildings which had been previously used for the detention camp, located inside of the San Lazaro boundary walls. These buildings were all entirely destroyed by fire during the month of May, and their site is now occupied by a modern hospital on the detached pavilion plan, capable when finished of properly caring for all classes of contagious diseases. The hospital buildings are rapidly approaching completion, and it is expected that they will be ready for occupancy early in October. They are well constructed of the best material and are planned along the most modern lines. Their completion will mark an entirely new era in hospital construction in the Philippines, and will reflect much credit upon those who have had their projection and construction in charge.

LEPER COLONY AT CULION.

On account of various unforeseen difficulties, the work of construction for the leper colony at Culion has made unsatisfactory progress, and relatively little has been accomplished. The work was to have been performed by the government, but it was not found practicable to secure sufficient laborers for its accomplishment. The report of

the sanitary engineer in charge, Mr. H. D. Osgood, is submitted herewith. It has been thought preferable to withdraw the government employees and material from the island and let out the work of construction to private contractors, who appear to have less difficulty in securing the necessary labor.

MUNICIPAL PHYSICIANS.

There are eight municipal physicians whose duty it is to render gratuitous medical assistance to the poor of Manila. The number of professional visits made by them is relatively small for a city of the size and character of Manila, and is due chiefly to the fact that the less intelligent classes, which it is particularly desired to reach, have not been accustomed to call in medical assistance in case of sickness and do not properly appreciate its value. They can not realize that the services of municipal physicians are given gratuitously, and are inclined to believe that by calling them in they are obligated to make payment for any services rendered. Being superstitious and fatalistic, and regarding disease as a sign of Divine displeasure, they consider that any attempt to relieve, other than by prayer, is not only futile but sacrilegious. A special effort is now being made to overcome these ideas and prejudices, and to give wider publicity to the fact that free medical attention is available for the indigent, while the work of the municipal physicians has been so reorganized that their services are now more generally available. There is no question but that the mortality rate, and especially the death rate among infants, would be very favorably influenced if the poor could be induced to make better use of the medical assistance placed at their disposal.

UNQUALIFIED MEDICAL PRACTITIONERS.

In spite of the existence of an excellent act regulating medical practice in the Philippines, a number of unqualified persons pretending to medical skill engage in the practice of medicine, by no means entirely among the lower classes. With the Filipinos, as among more highly civilized peoples, the self-assertive quack doctors are too frequently taken at their own valuation. Among the Chinese dependence is largely had upon this class of practitioners from among their own race, who practice according to Chinese customs and ideas. These unlicensed and unqualified medical practitioners are without education, and are grossly ignorant of the fundamental principles of the nature and treatment of disease. In consequence, their treatment is frequently directly harmful to the sick, while their employment for the care of a patient means that a more capable man is probably not called in; or if called, that this is not done until too late. While this class of unqualified practitioners of medicine undoubtedly does much harm, the sanitary authorities have as yet had their attention engaged by matters of greater urgency, and have not actively undertaken general measures for their repression.

FREE DISPENSARY.

A free dispensary is operated by the board of health at No. 96 Calle Santa Rosa, Quiapo, at which there were 6,658 prescriptions filled during the year. The clientele is practically limited to the Filipinos.

The small number of prescriptions filled is due to the fact that the less intelligent class of natives have a decided disbelief in medicines in case of sickness, and trust rather in the efficacy of prayer. The fact that there is but one dispensary, and that transportation about the city is difficult, also enters into the apparent lack of popularity of the system. The Chinese residents also place little faith in drugs other than their own, and rarely use those of civilized nations. With the better education of the masses to a more thorough appreciation of the value of medicines, the popularity of the free dispensary may be expected to undergo large increase. Under the Spanish administration there was no dispensary, but such prescriptions as were written by municipal physicians could be filled at any drug store, and the charge for the same was paid by the city. The board of health is at the present time preparing to operate two additional free dispensaries—one in Tondo and the other in Paco.

FREE CLINIC.

A free clinic, dispensary, and temporary tent hospital has been established by the Protestant Episcopal Church, on Calle Magdalena, Trozo, through the efforts of Bishop Brent. This office has given every assistance in its power toward this worthy institution, which will be of much value to the community.

MIDWIVES.

There are eight native midwives employed by the board of health, whose duty it is to attend, without charge, to confinement cases among the indigent in the city of Manila. These midwives have lately been assigned to duty at the several sanitary stations, so that their services may be more readily available and their work more effectively directed and supervised. It is hoped that through their agency the present excessive infant mortality, largely due to improper feeding and to tetanic convulsions from infection of the umbilical cord through uncleanly handling, may be materially reduced.

TRAINING SCHOOL FOR NURSES.

A bill for the establishment of a training school for nurses has lately been presented to the Commission. The purpose of this bill is excellent, as educated and scientifically instructed nurses are much needed in Manila and throughout the islands. It would seem that the plan should be drawn up on such broad lines that reputable persons of any nationality or sex should be admitted to the proposed school, so that no important class of the population of the islands need be without representatives properly instructed in the art of nursing along modern lines.

MORGUE.

Until within a short time the only morgue facilities available in the city of Manila were afforded by hospital tents pitched within the San Lazaro hospital inclosure. In the past few weeks a morgue building has been completed which, in its construction and arrangement, is modern in every respect, and is ample in size to meet all the needs of the city.

CEMETERIES.

The condition of the cemeteries in Manila has undergone much gradual improvement, though it is not as yet satisfactory. In the cemeteries within the city limits, not only are the niches in many instances in bad repair, but the height of the ground water renders the sites unsuitable for burial purposes. Thus in the Tondo Cemetery examination shows that the level of the ground water lies only 12 inches below the surface at the lowest part of the cemetery and but 20 inches at its highest part, and under such conditions with underground burial the process of putrefaction would not go on sufficiently rapid. Further, the present location of these cemeteries is undesirable, and in at least one instance the ground immediately outside the walls is closely built up with habitations. These cemeteries are overcrowded and insanitary, and in their present condition and location are a menace to the public health. They should be removed, and no new cemeteries allowed to be established in the future within the city limits. The action of the municipal board in deciding to secure additional ground for burial purposes in the La Loma district is much to be commended.

BURIALS AND DISINTERMENTS.

During the year there were 9,602 dead bodies disposed of; there being 385 bodies sent to the crematory, 7 forwarded to the United States, 4 shipped to the provinces, and the remainder buried.

There were 513 disinterments during the year from the city cemeteries, of which number 85 were from the Government cemeteries and 304 were from the Chinese cemetery. Attention is invited to the fact that the military burial corps has not governed its actions, with respect to the exhumation of dead bodies, by the law which requires that a minimum of two years shall elapse before the disinterment of a dead body can be authorized.

TROZO FIRE.

The board of health lost heavily in the destructive conflagration which swept over the Trozo district during the month of May. This district, which was closely built up with native houses of bamboo and nipa, was burned over for a space a mile long and two-thirds of a mile wide, rendering some 20,000 persons homeless within the period of two hours. The board of health corral, buildings of the pail conservancy system, cholera hospital, and detention camp were all located in the region devastated, and since the flames advanced with great rapidity there was little opportunity for the removal and preservation of property. All the buildings of the institution above named were destroyed, together with practically all property on the ground except public animals. The total loss to the board of health was \$103,969.30 in Mexican currency and \$4,348.55 in United States currency, or equal, at the rate of exchange at that time, to \$45,936.38 United States currency. Fortunately a part of the ambulances, wagons, and trucks of the pail conservancy system were absent at the outbreak of the fire, and additional transportation, horses, and harness were promptly purchased from the military supplies. A new corral was at once estab-

lished, and the headquarters of the pail conservancy system was removed to the offices of the board of health and its work reorganized on a new basis. A cholera hospital was at once improvised in an available building, and within twelve hours after the fire the board of health was continuing the work of transporting and caring for cases of infectious disease, and providing for the removal and disposition of excreta, as if nothing had happened.

On the day after the fire the board of health supplied tentage for all the homeless people who had not been able to secure shelter in other parts of the city. These tents were not generally used at first, as an idea gained ground among the natives that a high rental would be exacted for their use, and it was consequently necessary to post an announcement on each tent that no charge for occupancy would be made. A sanitary organization for the burnt district was created and temporary latrines established, with the result that the much higher rate of sickness which usually follows catastrophes of such character and magnitude was averted.

Following the fire the streets were properly widened and the district divided into suitable blocks by the city engineer, who also submitted a plan to the trustees of the San Lazaro estate for the subdivision of these city blocks into building lots of proper frontage and securing a passageway to the center of each block, where a space was to be reserved for a latrine to be used in common. Building permits for the erection of temporary houses, good only for six months, were also issued, with the idea of allowing shelters for the rainy season to be erected subject to future removal.

With respect to the establishment of a common latrine for each block, the board of health is at present unprepared to make the necessary installations, as the loss of property by the Trozo fire barely permits of the operation of the installations already in use through the city. Request has been made to the insular purchasing agent to purchase a sufficient number of additional sanitary pails, and as these are received the matter will be given proper attention.

BILIBID PRISON.

During the year there were 213 deaths among the convicts serving sentence in Bilibid Prison, out of an average daily number of 2,152 so imprisoned. This gives an annual death rate of 99 per thousand, or nearly three times greater than that for the general population of Manila during the same period. Considering the age and character of the convict class, and especially the fact that among the prisoners there can be no high infant mortality to disproportionately swell the death totals, this death rate of 99 per thousand per annum can only be regarded as highly excessive and well worthy of the most serious attention.

Attention in this connection is invited to the fact that a number of American prisoners are now serving sentences involving lengthy periods of confinement in these islands. Prison life at best exerts an unfavorable influence on the health of those in confinement, and in the Tropics the unfavorable effects already shown to result from confinement in Bilibid may be expected to appear among white prisoners at an early period and to more marked extent than in cooler climates. It is understood that a number of European nations having tropical colonies send white convicts sentenced to long terms of imprisonment to serve out

their sentences in the home country, because of the highly unfavorable effect of prolonged confinement within the Tropics upon the health and lives of such persons. It is submitted that a sentence involving five or more years' confinement in the Tropics is much more liable to shorten the lives of white prisoners than the same period of confinement in the United States, and the actual severity of such punishment to be served out here is thus materially increased. On sanitary grounds it is believed that the question of removing long-term American prisoners from the islands to serve out their sentences in the United States should be given serious consideration.

Considering the appalling mortality in Bilibid and the character of the diseases with which the prisoners are affected, there is no question but that the latter are suffering greatly from the effects of crowd poisoning. The prison must be regarded as overcrowded, and not having its inmates divided into sufficiently small group units; there are not suitable facilities for the isolation of those affected with infectious disease; all space inside the walls should be thoroughly concreted so as to be readily flushed and drained; the medical service of the institution is under manned. These and other sanitary points require earnest attention.

LOUISIANA PURCHASE EXPOSITION.

During the past few months an exhibit relating to the work of the board of health has been in process of preparation by a committee, for display at the exposition at St. Louis in 1904. This exhibit will consist of charts, maps, a large collection of photographs, and of the laws and other printed matter relating to this department. As the exposition authorities have appropriated \$1,000 for its preparation, it is expected that the display will be very complete, and not only attractive to the ordinary visitor, but instructive to those especially interested in sanitary work.

GOVERNMENT LABORATORIES.

Much valuable work of a sanitary nature has been done at the government laboratories during the year and much valuable assistance rendered this office.

SANITARY LAWS.

The sanitary authorities have received the utmost assistance in their work through the enforcement of sanitary laws by the impartial justice meted out in the courts of Manila. Without such judicial support the efficient performance of sanitary work in the city could not have been possible, as the necessary reforms and improvements were only to be obtained as a result of knowledge that disobedience or neglect of sanitary orders would entail severe penalties. Property owners are generally totally indifferent to the sanitary needs of their tenants. An idea appears to have been entertained in some quarters that the sanitary laws would not be enforced in the case of persons belonging to the wealthier and more educated classes, but this belief has been shattered by the conviction and sentence of a number of such individuals before the courts. These wealthier persons largely represent the land-

lord class, upon which devolves the expense of placing the premises owned by them in good sanitary condition, and the conviction of a few individuals of this class has been productive of far better results in the way of securing sanitary improvements in tenements and other houses, without undue general opposition, than if a much larger number of individuals of less importance in the community had been so penalized.

In contrast with the results secured in Manila in the enforcement of sanitary laws, quite the opposite has obtained in the provinces, where, as a rule, it has not been possible to procure conviction and adequate penalty for sanitary delinquencies. Where laws, the execution of which implies inconvenience and discomfort, can be ignored with safety by those concerned, it is certain that their provisions will not be carried out. This fact has repeatedly been demonstrated in the provinces, and to it the failure to secure proper results in such localities from excellently planned sanitary measures has not infrequently been due. The laws must be made for the Filipinos and enforced among them, for they are not yet sufficiently civilized to appreciate their importance. It is earnestly hoped that the authorities may not yield to solicitation and emasculate the sanitary laws at the request of those who are not yet competent to pass upon their necessity.

The present laws for the sanitary government of the city of Manila are incomplete, inconsistent, and do not properly meet the needs of the situation. Further, the functions and powers of the board of health and certain of its officials are much confused by the provisions of acts Nos. 157 and 183, Philippine Commission. A compilation of existing laws, ordinances, and provost-marshal-general's orders has been prepared in this office, together with drafts of such proposed laws as appear to be necessary, and this work is now being carefully gone over by a committee, one member of which has been detailed for this purpose from the office of the attorney-general. It is expected that the report of this committee will furnish a basis for such much needed legislative action as will clear away existing inconsistencies and regulate matters not at present covered by sanitary laws.

During the year the following acts were drafted by the board of health and submitted to the Commission, or municipal board:

An act regulating the manufacture and sale of aerated, mineral, and bottled waters, sirups, beers, or other drinks in which water is used.

An act to provide for the safe and humane transportation of animals by water in the Philippine Islands.

An act relative to the immunization and movement of cattle and carabaos in the Philippine Islands.

An act relative to the quarantining of equines imported into the Philippine Islands and for the control of surra or trypanosomiasis.

An act relative to the establishment of a training school for female nurses.

An act providing for the quarantining and compulsory inoculation against rinderpest of horned animals in the Philippine Islands.

An ordinance regulating plumbing, the issuance of plumbers' licenses, house drainage, and the making of openings in the street.

An ordinance relative to the period of detention of smallpox and plague cases and suspects.

The following acts were enacted by the Commission:

An act regulating the practice of dentistry in the Philippine Islands.

An act relative to the practice of pharmacy in the Philippine Islands.

An act regulating the practice of medicine and surgery in the Philippine Islands.

ASIATIC CHOLERA.

This disease is the one which has occupied the attention of the board of health to the greatest extent during the year, both in Manila and the provinces. It can not at the present time be discussed in extenso, however, since the statistics for the disease are not yet properly digested, and any report should preferably treat of the epidemic as a whole down to the time when the cholera infection shall have disappeared from the islands. For these reasons the full discussion of the cholera epidemic has been postponed to a later date, when the subject will be handled in its entirety in a special report.

It is hardly possible to overestimate the suffering and financial loss which have attended the spread of cholera through these islands. Up to September 1, 1903, there were officially reported as occurring throughout the islands 157,036 cases of cholera, with 102,109 deaths. These numbers, while large, probably do not represent as much as two-thirds of the cases and deaths which have actually occurred, since, for various reasons, many cases of the disease do not figure in the statistics. Numerous deaths have occurred in towns not possessing physicians or persons capable of diagnosing cholera, and probably many cases were not so diagnosed until the epidemic had become well advanced and no doubt could be left as to the nature of the disease. Many communities had no sanitary organization, and of course among the various wild tribes no records whatever have been kept. There is also reason to believe that in many instances bodies were intentionally buried under false returns as to the cause of death, so as to permit the survivors to escape the annoyances and expenses of quarantine and disinfection. For these reasons the official returns as to cases and deaths may be accepted as by no means indicating the magnitude of the epidemic.

Practically no portion of the islands, from Aparri to Bongao, has escaped the disease. The cholera infection has been carried from island to island by steamers and fishing boats and into the interior by canoe, bull cart, or by pedestrians. Once the infection had escaped beyond control in Manila there was practically no stopping it. Land quarantines were tried, but proved futile. Quarantine by sea, temporarily, proved more effective, but in these island waters small fishing boats are able to go anywhere, and it has been relatively easy to evade port quarantines under such circumstances. The natives generally could not be made to appreciate the necessity for quarantine, and there were always many who were so opposed to it as to destroy any chances of successfully limiting the disease by this means. One noteworthy exception in this respect, however, stands forth. The province of Lepanto-Bontoc, which can be entered only by a few narrow trails, was easily quarantined, and its usual light trade with the coast was almost abandoned. It therefore escaped the scourge entirely. The spread of the disease through the islands has practically depended upon the unwillingness of the natives to carry out the necessary measures to prevent it, for which neglect they have in due time paid full penalty.

The history of cholera in the small towns during the present epidemic has presented instances over and over again where the disease has been stamped out by proper measures applied by American physicians, even after it had secured a strong foothold, but in the vast

majority of cases no intelligent and comprehensive effort was made by the natives to eradicate the infection. Not only was the supply of disinfectants scanty, but the principles of disinfection were not understood, so that the crude and incomplete efforts made by the natives to this end amounted to practically nothing. Generally a partial effort was made by the local authorities to clean up the town, but not always. The markets were often inspected; more attention was paid to their cleanliness, and the sale of objectionable food in them was prohibited. A few of the more intelligent people were careful as to what they ate and drank, and many took more care in choosing and caring for their drinking water than ever before. In this latter respect the influence of the cholera epidemic will last a long time. Unfortunately, however, the preventive measures taken were not general, nor were they sufficiently comprehensive to be of any great value. The mass of the people were fatalistic and inclined to regard the cholera as a sign of divine displeasure, and under such circumstances any attempt to avert the disease, except by prayer, was regarded as both useless and impious. For this reason cholera spread almost unhindered while the people gave themselves up to churchgoing, prayer, and religious processions. The sick with cholera were generally cared for in their houses by members of the family. Having no knowledge of the infectious nature of the disease, those who attended to the sick took no precautions for their own safety, and frequently died. Many of the cases were never seen by physicians. In a relatively small number of cases the towns established cholera hospitals; but these were not popular, and were avoided as far as possible. Burning of the dead was at first tried by the military surgeons, but was repugnant to the religious ideas of the natives. Special cholera cemeteries were generally opened, but not until the old cemeteries contained many cholera bodies. There were usually no special precautions taken for disinfecting the bodies in regard to burial, nor were the bodies in all cases properly interred.

When the central board of health could send its medical inspectors to a cholera-smitten district the situation soon showed marked improvement. Unfortunately it did not have men, money, and materials to cope with the disease all over the islands, and consequently the cholera in the majority of the provinces has been largely left to burn itself out.

A noteworthy feature of the outbreak was the limited number of persons apparently susceptible to the disease at any one time; where a whole community was apparently exposed to the infection, it was rare that more than 15 or 20 per cent contracted the disease. The type of the disease, as represented by the case mortality, also varied in different towns and in the same towns at different periods. The disease was usually water-borne; more rarely it was conveyed by food and, in a few instances, by contact or flies. Among the natives, when the disease was not looked upon as retribution for sin, it was frequently regarded as due to poisoning of the drinking water by the Americans.

In Manila, for the entire period of the cholera epidemic—March 20, 1902, to September 1, 1903—there have occurred in the city 5,112 cases of the disease, with 3,958 deaths, giving a case mortality of 77.2 per cent. For the twelve-month period prior to September 1, 1903, there occurred 1,179 cases, with 894 deaths, giving a case mortality of 75.8 per cent. For the entire epidemic there were 3,309 cases and 2,568

deaths among males and 1,789 cases and 1,384 deaths among females, the sex not being noted in 14 cases and 6 deaths. These figures show an incidence of the disease about twice as great among males as females, due to the greater exposure to infection of the latter along the water front while acting as sailors, stevedores, and boatmen, and to the greater liability of contracting the disease in the small food tiendas, chiefly patronized by males.

During the entire outbreak the cases of cholera have been distributed, by race, as follows:

Race.	Cases.	Deaths.	Case mortality.
			<i>Per cent.</i>
Americans.....	163	77	47.2
Europeans.....	63	35	55.7
Chinese.....	383	187	48.8
Filipinos.....	4,457	3,635	81.5
All others.....	35	22	62.8
Not stated.....	9	2	.....

These figures show that the Filipinos have been not only much more liable to contract cholera than are the Chinese or Americans, but that, when they do get the disease, they are almost twice as liable to die therefrom. The number of Chinese who have developed cholera in proportion to the Chinese population is relatively small. This is probably influenced by the fact that this element of the population largely uses cooked food and also boiled water for drinking purposes in the form of tea. The number of Americans who contracted the disease is unduly high; but the cases occurred largely among soldiers who entered native houses and partook of native foods and drinks in defiance of standing military orders.

The cases and deaths in Manila from March 20, 1902, to September 1, 1903, were distributed, by city districts, as follows:

District.	Cases.	Deaths.
San Nicolas.....	705	517
Tondo.....	1,069	863
Binondo.....	392	385
Santa Cruz.....	631	477
Intramuros.....	293	166
Quiapo.....	245	175
Sampaloc.....	419	324
Malate.....	69	43
San Miguel.....	292	218
Ermita.....	235	164
Paco.....	298	222
Pandacan.....	60	36
Santa Ana.....	69	40
On water.....	292	224
Not stated.....	25	196

The districts have been largely affected in proportion to population, except in the case of San Nicolas, in which the rate has been unduly high. Probably a large number of cases of cholera developing on boats lying along the water front of this district, which have been removed to the shore, have been taken up as belonging to San Nicolas.

The mortality of the disease has also varied. Thus, of the cases occurring in 1902 the mortality was 80.7 per cent, while of those occurring in 1903 the mortality was 85.6 per cent. The type of the disease during the present year has thus been much more fatal,

though the actual number of cases has been much less, amounting to but one-tenth of the number of cases occurring in almost exactly the same period of time in 1902. This decrease represents the results of a more effective sanitary organization in the city, for the natural conditions are fully as favorable to the development of a widely spread epidemic this year as a year ago. Fortunately the board of health has succeeded in keeping the city water supply free from infection, in default of which the number of deaths from cholera probably would have been multiplied twentyfold. It would seem to be more than a coincidence that 385 out of 392 cases occurring in Binondo should result fatally, while in Sampaloc there were but 324 deaths in 419 cases.

During the entire epidemic in Manila the cases of the disease have been distributed, by age, as follows:

Age.	Cases.	Deaths.	Case mortality.
			<i>Per cent.</i>
Under 1 year	45	43	95.55
1 to 5 years	410	349	85.12
6 to 10 years	306	241	78.75
11 to 15 years	269	194	72.11
16 to 20 years	555	379	68.28
21 to 25 years	730	504	69.04
26 to 30 years	852	617	72.41
31 to 35 years	502	357	71.11
36 to 40 years	441	330	74.82
41 to 45 years	229	170	74.23
46 to 50 years	206	163	79.12
51 to 55 years	106	74	69.81
56 to 60 years	168	134	79.76
61 to 65 years	50	38	76.00
66 years and over	129	104	81.39
Unknown	114	261	.....

From these figures it would seem that early adult life is the period in which recovery is most liable to occur, while the mortality is the highest at the extremes of life.

In keeping cholera in the city of Manila down to the figures above quoted for the present year, the sanitary authorities believe that there is reason, under existing local conditions, to feel well satisfied with the results. In spite of the widespread development of cholera on the watershed of the city supply during the present year, the board of health has been able to prevent the infection of the water supply, which would unquestionably have resulted in the death of many thousands in Manila, and to bring the outbreak on the watershed to an abrupt close. In the city the esteros and river have been bacteriologically demonstrated to have been infected, and in the absence of the usual heavy rains it has been impossible to free them of infection. It has not been possible to prevent all persons from using this infected water, and thus from acquiring the disease, but the precautions taken by the sanitary authorities during the present calendar year have been able to prevent the disease from spreading as an epidemic from the cases thus developed.

BUBONIC PLAGUE.

During the year there was an outbreak of bubonic plague in the city aggregating about 200 cases. This was presumably developed from the slight infection able to maintain itself in the city subsequent

to the energetic repressive measures carried out in 1901, and which in the year 1902 resulted in the development of but 9 cases of the disease. This small number of cases was perhaps responsible for overconfidence by the authorities that but little more need be feared from plague, and in the presence of cholera epidemic the few cases of this disease which developed were relatively so insignificant in number as to receive little attention. During the cholera epidemic the board of health necessarily concentrated all its energies on the repression of that disease, and the special measures for the extermination of plague were abandoned. With the beginning of the present calendar year cases of plague began to appear, and their numbers increased at a rapid rate. Fortunately, by this time there was such a marked improvement in respect to cholera conditions that the board of health was again in a position to undertake proper preventive measures, under which the disease diminished in what may be regarded as a very satisfactory manner. During the year plague prevailed to an alarming extent in many of the cities of the Orient and throughout the world, and appears to have generally increased in severity as compared with previous years. Considering the almost identical manner of its appearance and development in Manila and other oriental cities, it would seem justifiable to consider that a severe epidemic has been escaped here only through the effectiveness of the preventive measures employed.

The subject of bubonic plague in Manila is discussed in a special paper by Dr. E. L. Munson, hereto appended, to which attention is invited.

SMALLPOX AND VACCINATION.

During the twelve months prior to September, 1, 1903, there were 99 cases of smallpox in Manila with 16 deaths, or no more than occur from this cause in various cities in the United States of equal size and having a large dark-skinned population. It may be noted that, of the above cases and deaths, 9 cases with 4 deaths occurred in Americans, a number of this class not having been properly protected by vaccination.

Several outbreaks of smallpox have occurred during the year among the natives in the provinces, particularly in the Cagayan Valley and Camarines of Luzon, and in the southern islands. This office at once sent vaccinators to the scene where these could not be provided by the provincial authorities, with excellent results in respect to the abatement of the epidemics where the vaccination of the people could be efficiently carried out. No more conspicuous example could be mentioned of the thoroughness with which the Americans have carried out sanitary measures in the Philippines, as compared with similar measures under the Spanish administration, than those which have to do with the protection of the population of Manila against smallpox by means of vaccination. The records kept by Señor Saturnino Espejo, chief vaccinator, under both the Spanish and American administration, show that from the 3d of November, 1894, to the 25th of October, 1898, on which latter date the administration of affairs was turned over to the United States, a total of but 9,136 vaccinations were made in the city of Manila, while in the two months of November and December of the same year the Americans caused the vaccination of 10,477 persons in the city, or a greater number within these two months than

the Spaniards had vaccinated in the previous five years. In the following year, 1899, in spite of the existence of the Filipino insurrection, 103,931 persons were vaccinated in the city. In 1900 there were 60,592 persons so vaccinated; in 1901 there were 68,144; in 1902 there were 96,823, and in the twelve months September 1, 1902, to September 1, 1903, there were no less than 154,706 persons vaccinated, representing a number equal to 70 per cent of the population of the city. In regard to the results obtained in the city of Manila 43.6 per cent of the vaccinations made were reported as successful, the figures also including those for revaccinations. These results bear witness to the excellent quality of the vaccine virus prepared at the vaccine farm. So far as known, no bad results have developed as a result of vaccination. The work of vaccination has been well organized by Señor Saturnino Espejo, who has showed much ability in its execution. As a result of the thorough vaccination carried out, smallpox has ceased to be a factor of any importance in the Manila death rate. Cases which occur among residents in the city are relatively few and of a mild character. A considerable part of the cases occur in transients and in this class a large proportion of the deaths occur. Two American school-teachers, recently arrived from the provinces, who had evaded vaccination, developed the disease and died. Vaccination in the provinces is carried out by vaccinators under the provincial boards of health. Where funds for their payment are not available in the provinces, the necessary vaccinators are employed by the board of health for the Philippine Islands. This office is not as yet in possession of data showing the total number of vaccinations performed throughout the archipelago during the past twelve months, but the total vaccine virus issued during that period for use in the islands has amounted to no less than 1,161,909 units. From these figures it is probable that at least one-eighth of the total population of the islands has been protected against smallpox during the past year. In the course of a very few years, as the work of vaccination is continued and the sanitary machinery more efficiently organized, there is reason to hope that practically the entire population of the islands may be thus immunized against the former great scourge of smallpox and the disease caused to disappear.

One great difficulty with respect to the carrying out of vaccination has been found in the defective means of transportation through the islands, by which the movement of the vaccinators is hampered and the vaccine virus is sometimes spoiled when received. There have been a few instances also in which the work of vaccination has been temporarily discontinued as a result of the prejudices of the people and to avoid the creation of undue opposition. Experience has shown that the most effective and economical method of carrying out vaccination in the provinces is by sending out experienced vaccinators from Manila.

MALARIAL FEVERS.

Malarial disease is by no means as common or dangerous in the Philippines as in many other parts of the Tropics. This is due to the fact that the species of mosquito, which is recognized as the transmitting agent of the malaria parasite, does not ordinarily find congenial environment and facilities for development in the low-lying lands along the seacoast, where the greater part of the population is

established. In the interior, however, even at a considerable elevation, there are certain districts recognized as malarious, and in these zones the malaria-transmitting mosquito is commonly found. Particularly in the southern islands malaria is most prevalent, and there also the type of the disease is more severe. For the city of Manila, for the twelve months ending September 1, 1903, there were 226 deaths reported as occurring from malarial fevers and results thereof.

DYSENTERY.

During the year there were 236 deaths from dysentery reported as occurring in the city of Manila. The disease is one to be particularly dreaded by the white race in the Tropics generally, as persons of this class appear to be not only more liable to contract the disease, but to possess less resistive powers against it. Among the Chinese, on the contrary, the disease appears to tend toward recovery, and abscess of the liver resulting therefrom is rare. The disease in Manila appears to depend almost wholly upon the use of unboiled water. Even the city water is unsafe in this respect, and its routine examination in the laboratories discloses the almost constant presence of amœbæ therein. With the construction of a new system of waterworks furnishing an unpolluted water supply a marked decrease in the number of cases of dysentery occurring in the city may confidently be anticipated. With few exceptions the use of surface water or that from shallow wells throughout the islands, unless the water has been sterilized by boiling, must be regarded as highly inadvisable from a sanitary standpoint.

LEPROSY.

Reports rendered to the board of health show the existence of 3,323 lepers in the Archipelago. These reports include by no means all the existing cases in the islands, but undoubtedly cover the large majority. Probably a fair estimate of their total number through the islands would be less than 6,000, or a small fraction of the number as originally estimated. Nearly all are cared for by their families or friends. At present but 434 are segregated in leper hospitals, but with the completion of the leper colony now under construction at Culion, their removal to that island will be carried out as rapidly as possible. The 202 lepers at San Lazaro Hospital, in Manila, are well cared for, and appear to be comfortable and contented. The disease generally appears to be of a very slowly progressive type, and there is relatively little disfigurement and mutilation as compared with the results of this disease as seen in other countries. Apparatus for the treatment of leprosy by the use of the X-ray and of the Finsen ray has been supplied to the San Lazaro Hospital; but the apparatus having been only recently received, no statement can as yet be made as to the efficacy of this method of treatment. During the year but one death from leprosy occurred in Manila.

BERIBERI.

This is one of the more important causes of death among the Filipinos and Chinese, occurring particularly among the poorer classes. Whites are relatively very insusceptible to the disease, and but few cases occur among them. During the year prior to September 1,

1903, there were 313 deaths from this cause in the city of Manila, and a severe outbreak occurred among the prisoners confined in Bilibid Prison. Of these 313 cases, none were whites. The etiology of this disease is in doubt. While the latest view is that it is of an infectious nature, such epidemic outbreaks as have occurred in Bilibid and elsewhere would seem to show that its development is greatly favored by a diet deficient in nitrogen, which, if not the exciting cause, must be regarded as at least a powerful predisposing factor. In the absence of definite knowledge of the cause of beriberi, it is impossible to formulate any special measures for its prevention. While the adoption of a higher standard of living would very probably be of value as increasing the powers of vital resistance, improvement in this respect, for the general population here, must naturally depend upon economic conditions.

VETERINARY DIVISION.

The work of inspection of animals arriving at the port of Manila and at the city abattoir prior to slaughter is carried on by veterinary surgeons under this Department. During the year 95,360 animals were inspected on arrival at the port and 91,442 were inspected prior to slaughter at the abattoir. A total of 394 animals were condemned for disease and their bodies cremated.

DISEASES OF LIVE STOCK.

The subjects of rinderpest and trypanosomiasis, or "surra," have received much attention from the board of health during the year. Both of these diseases have prevailed to considerable extent in many parts of the Archipelago, and reports received from medical officers in the provinces state that in certain districts as much as 90 per cent of the carabao and cattle and 60 to 75 per cent of the ponies have been destroyed by these diseases. Under such conditions agriculture has been largely interfered with.

That the importance of "surra" is fully recognized in the islands is shown by the dispatching during the year of an army commission, composed of two line officers and a veterinary surgeon, to India, Burma, and the Dutch East Indies, for the purpose of making inquiry relative to this disease, while investigation under the board of health into the same subject was carried on in Manila at the government laboratories. The army commission arrived at the conclusion that "surra" was probably transmitted by the use of fresh grass and water from infected localities. The investigators in the government laboratories, by a long series of experiments, found that "surra" was a disease the parasite of which gained entrance to the system only by inoculation, either through wounds made by biting flies, or by being mechanically brought into contact with open sores. Feeding experiments with food and water known to be infected with parasites of the disease were invariably negative, unless slight lesions were freshly made in the mucous membrane of the mouth, when the disease invariably occurred. As a result of these investigations, it would appear that infected food and drink play no part in giving rise to the disease, unless under very exceptional circumstances. The investigators at the government laboratories also conclude that this disease has been newly introduced into the Philippines; that it will rapidly extend among wild and

domesticated animals in the absence of suitable measures of repression; that biting insects are the chief agent in the spread of the disease, and that an animal once infected can not at present be cured and should be promptly destroyed and disposed of as soon as the diagnosis of the disease can be made. Based upon the careful investigations made at the government laboratories, the board of health has drafted a bill for the prevention and control of "surra," and submitted the same to the Philippine Commission for its action.

Much has been done by the board of health for the prevention and control of rinderpest. The method of prophylactic inoculation of bovines has undergone such improvement that in Manila but a very small percentage of the animals so protected against the disease succumb at the present time as a result of the operation. By such protective inoculation the ravages of the disease can now be stayed, and the board of health has through its agents done much immunizing work along these lines with very satisfactory results in Manila and the provinces. All of the 10,000 carabao, now being imported from China by the government to partially replace those lost in the islands from disease are required to be immunized against rinderpest before shipment. This work of immunization is supervised by an agent of the board of health. At first about 15 per cent or more of the animals to be imported died as the result of the inoculation. Serum was then furnished from Manila, with the result that it is stated but two or three animals subsequently died out of each hundred. By thorough inoculation of the bovines in the islands, and by the quarantining of all animals imported, there are good reasons for hoping that rinderpest may ultimately be eliminated from the Archipelago. To this end the board of health has drafted a bill for the proposed laws concerning rinderpest, and has forwarded the same to the Philippines Commission for its action.

As if "surra" and rinderpest were not evils of sufficient magnitude, the highly infectious and extremely fatal hemorrhagic septicemia of cattle was brought to these islands in the month of May by a small herd of carabao imported from Hongkong, where it is understood that this disease is quite prevalent. Of the various animals exposed to the infection of hemorrhagic septicemia while en route here and after arrival, all contracted the disease and died therefrom. Fortunately the infectious nature and dangerous character of the disease was recognized before the infected animals had left quarantine.

QUARANTINE STATION FOR LIVE STOCK.

The urgent necessity for the establishment of quarantine stations for animals imported into these islands has been particularly evident through the large purchases of animals which have been made abroad by the Government, from the fact that so many animals arriving in the islands are affected with dangerous epidemic diseases, and by reason of the special efforts being made by the board of health to limit and control diseases among the animals already in the islands. A number of suggested sites for the cattle quarantine station for Manila have been examined, and ground for the station finally leased on the range of hills near San Felipe Neri. The cattle will be taken up the Pasig on lighters and unloaded on a wharf built into the San Juan

River near its junction with the Pasig. The station includes an area of about 15 acres, divided into 10 sections by double fences. One section will be fitted up with inoculation stalls and will also contain the offices and feed house. The other nine sections will be divided by single fences into four pens, each large enough to hold 50 head of stock. In each of these pens will be built a feed house, watering trough, and shed for shelter of the animals. Outside of the station proper will be two sections to be used for experimental purposes, and any ground not occupied by the station will be used for grazing. The station as above planned is intended for horned cattle and will accommodate some 1,500 head, owned by various parties. Work on this new cattle quarantine station near Manila is being pushed as rapidly as possible; and it is proposed to provide similar stations at the earliest practicable moment for the other ports of entry through the islands.

LOCUSTS.

It is difficult for persons unacquainted by personal experience with conditions in the Philippines to appreciate the devastation and loss caused by locusts, which often fly in clouds large enough to darken the sun for those under a passing swarm. The destruction of these insects has engaged the attention of the board of health to a considerable extent during the past year, assistance and material to this end being furnished from Manila on the request of provincial governors or presidents of provincial boards of health. The use of fungus has proved of much value in the destruction of the adult locust—the infected insect soon sickens and dies. Thus the president of the provincial board of health of Bohol states that the use of fungus at the town of Dimiao destroyed locusts to the extent of between 400 and 500 cavanese, about half a ton in weight. The swarms are infected by the use of small pieces of bread infected with the fungus and strewed in the line of advance of the swarm, or insects are captured in nets, infected with the fungus and then freed among their kind to spread disease among them by contact. By following the swarms for several days and continuing this procedure vast numbers of the insects have been destroyed and certain swarms practically exterminated. The use of fungus has certain imperfections however, as it is efficacious only in destroying the adult insects; and further, the use by the natives as food of locusts killed in this manner is highly prejudicial to health, as severe gastrointestinal disorders are thus set up. The younger locusts not yet able to fly appear to be resistant to the action of the fungus, and their destruction has been best accomplished by searching out their breeding places as soon as hatching occurs, digging trenches in the line of advance of the swarm and burning or covering over with earth the insects which have fallen into it. By setting up temporary barriers of sheet iron or other material the young locusts may be driven so as to converge toward the place where arrangements have been made for their destruction. As locusts form no unimportant part of the diet of the country people of the poorer class, the latter are not all in sympathy with the work of locust destruction, which means the deprivation to them of a valuable source of food supply. The planters, however, are naturally very anxious to see an end of this insect pest, which is the cause of an immense amount of damage to crops. The recent passage of an act by the Philippines Commission creating provincial locust boards and authorizing the calling out of every able-

bodied man in a locality, under severe penalty for noncompliance, to unite in fighting against the common locust enemy, can not fail to be of much immediate advantage and may ultimately bring this scourge of the agricultural districts to an end.

PROVINCIAL SANITARY CONDITIONS.

The general sanitary condition of the islands and the provincial towns can not be regarded as satisfactory, though undergoing steady improvement. In its work of organization and administration this office is hampered by the great lack of properly qualified Filipino physicians in the provinces, and as a result it not infrequently happens that in towns of considerable size there is no educated medical man available to fill the place of municipal health officer. The great dearth of educated medical men throughout the islands is without doubt an important factor in an elevated mortality rate, since there are thus few to whom the natives can resort for medical treatment and advice as to the prevention of disease. As a great part of the deaths occurring in Manila occur without medical attendance, so this is true in even larger measure of the provinces where for lack of proper care many lives are unnecessarily lost. With the education of a larger number of Filipino youth as medical men, which must in turn depend upon an increased demand by the people for trained medical services, this need will be satisfied.

In the provinces the people themselves stand in the way of their own sanitary advantages to a greater extent than in Manila, as they are even more superstitious and less advanced in the matter of education than the Filipinos of the capital. Without education it is very difficult to make the necessity properly understood for observing the ordinary rules of hygiene. It takes time to impress upon a people long accustomed to regard epidemic diseases as retribution for sin the fact that its development is largely under human control and that it may be avoided by a few simple precautions, and the teachings of centuries in this respect are not to be overthrown in a day. The solution of this difficulty will be found in education in matters of hygiene, this education to be especially directed toward the present younger generation.

The difficulties in the matter of transportation through the provinces have also interfered with the efficiency of the sanitary organization, particularly in the rainy season. With practically no roads, communication in many districts is to be had only on foot or horseback. The monsoons also render travel by sea on the two sides of the Archipelago difficult during the alternate half years, while with few exceptions the rivers are not sufficiently large to permit the country to be penetrated any great distance except by small boats. Communication by railroad is of course at present limited to the single line operating between Manila and Dagupan. This condition will be remedied in time as the country is opened up, the number of wagon roads is increased, and a greater mileage of railroad track is laid down.

The relative poverty of the people also stands in the way of the highest sanitary efficiency in the provinces. Municipal funds are not usually forthcoming to attract the services of the best men, or in some instances of any qualified men at all. Municipal sanitary improvements are often financially beyond the reach of the municipality, and

it is of no use to urge the great need for such improvements if funds are not available to pay for them. This difficulty depends for its removal upon an improvement in financial and industrial conditions, which, in their turn, depend to a large extent upon better sanitation.

The provincial board of health has the following organization: A president, who is to be a duly qualified physician; the president of the municipal board of health of the capital, and the provincial supervisor. The senior medical officer of the Army or Navy on duty at the capital may be an honorary or consulting member, but will not be entitled to a vote.

With respect to the above plan of organization, the scheme at present in operation is not entirely satisfactory. In view of the frequently considerable distances involved, great difficulty of communication and the character and degree of education of the people, it would seem as if the provincial boards of health are too loosely bound to the central controlling body at Manila and do not sufficiently come under its direct supervision. While a number of the presidents of provincial boards of health are excellent men, who may safely be intrusted with the management of sanitary affairs in their provinces, this is not always the case. During the cholera outbreak the inefficiency of some of these men has been demonstrated, but unfortunately the dearth of qualified Filipino physicians in the islands does not always permit the replacement of these relatively inefficient men by those better qualified for their positions. Some of the provincial health officers are very earnest and energetic in carrying out instructions, but their services would perhaps be of more advantage if they could be immediately supervised and directed by some one of wider experience in sanitary matters. It would seem to be of much advantage, therefore, if the islands could be divided into districts, each of which should include within its limits several provinces, varying in number according to their size, population, and facility of intercommunication, and an experienced medical officer could be placed in charge of the sanitary affairs of each district and stationed at some point convenient for this purpose. It should be his duty to advise and direct the several provincial health officers as the representative of the board of health, and by frequent tours of inspection and regular reports from his subordinates he would be able to keep this office much better informed than at present as to the condition of sanitary affairs in the provinces of his district and their municipalities. It would be his function to see that a complete system of municipal boards of health was organized and that the officials of such boards were properly instructed and efficient in the performance of their duty. It should fall to him to investigate into and, if necessary, assume charge of epidemics of infectious disease, and he might well be furnished with a reserve supply of disinfectants, to be kept on hand at his central station as available to meet such emergency. He should also have immediate charge of the work of vaccination in the provinces of his district. He might well be required to attend to the officials of the civil government located in his vicinity. Being on the ground, and at the same time unswayed by local influence, he would be thoroughly conversant with the existing conditions and possess such wide acquaintance that his advice to the board of health in matters affecting his district would be of much value. This matter of district supervision is fully as important in respect to the work of the board of health as it is in respect to such district control now existing in the bureau of education or the judiciary.

Quarterly reports to be rendered from the provinces have not in many cases reached this office promptly by reason of cholera or pressure of other work. They have also been made out in so many different ways that their figures were largely unavailable for general statistical purposes. A blank form for statistical report is now being prepared, which will render the information furnished from the provinces in the future not only more complete but much more valuable for general statistical use.

SPECIAL SANITARY INSPECTIONS OF PROVINCES.

During the early part of the present year a number of medical officers were sent through various provinces for the purpose of examining into and reporting upon sanitary and economic conditions, the most prevalent diseases and the measures being taken to prevent those of an epidemic nature, and the diseases of animals. They were also instructed in the methods of carrying out their sanitary duties. The reports rendered by these officers on the completion of their duties contained much valuable information with respect to economic conditions in the provinces inspected by them and several are hereto appended.

OFFICE FORCE.

The commissioner of public health has been fortunate in having the assistance and support of a body of well-trained, trustworthy, and capable men, who have performed the duties intrusted to them, as a rule, with thoroughness, readiness, and loyalty.

Especial attention is called to the valuable work which has been done, not only in Manila but in the provinces of Albay and Sorsogon, by Dr. T. R. Marshall, chief health inspector. Doctor Marshall within a very few days collected the matériel for the construction of emergency hospitals in those two provinces, rendered necessary by the outbreak of cholera and smallpox in April, 1903. With the assistance of medical inspectors, Doctors Arbella and Rosario, and two chief sanitary inspectors he established hospitals of approximately 120 beds in those provinces, organized the hospitals, employed the necessary personnel, and relieved the situation. Doctor Marshall's work is worthy of the highest commendation.

The thanks of the commissioner of public health are due to Capt. E. L. Munson, assistant to the commissioner of public health, who has undertaken the onerous task of preparing the annual report. He has been indefatigable in his collection of data, in arranging the facts in logical sequence, and in preparing an orderly account of the work of the board of health. Captain Munson has had entire charge of this matter, and the commissioner of public health has felt that it would be handled quite as well while he was absent on other duties as if he were present.

Dr. R. E. L. Newberne, medical inspector, has assumed various duties in addition to his regular ones, such as acting with the civil-service board, supervising property returns, etc. Doctor Wilkinson has established a thorough practical working system in the various hospitals for contagious disease situated on the San Lazaro estate. He has made many improvements and his work is worthy of praise.

Dr. Manuel Gomez, the accomplished secretary of the board of health, has been of the greatest assistance to that board and to the

commissioner of public health by his sound judgment and good advice. He is a most valuable man.

It was a source of regret to the commissioner of public health that Doctors Du Bois, Wallace, Hack, and Davis decided to return to the United States at about the expiration of the fiscal year. These physicians possessed the experience, capacity and integrity that are so much needed in the Philippine Islands. The loss of their services was a grave blow to the board of health.

Dr. Arlington Pond has shown a special aptitude in the work assigned to him, and his services have been of particular value in the inoculation of the Chinese against plague, and also in the Mariquino Valley, where it became necessary to establish a sanitary régime of the most rigid nature.

The commissioner of public health desires to express his appreciation of the good work done by Doctors Arbella and Rosario, medical inspectors, and by Dr. Tee Han Kee and other municipal physicians.

To Doctor Cook was assigned much difficult and delicate work in the provinces, all of which he preformed to the satisfaction of the commissioner of public health. To Dr. C. F. De Mey fell the tedious and troublesome task of caring for the employees of the board of health on the island of Culion, a task which he performed energetically and conscientiously and which nearly wrecked his health permanently.

The commissioner of public health wishes to call especial attention to the careful and scientific work of Mr. August Jardin, sanitary engineer for the city of Manila, and of Mr. Henry Osgood, sanitary engineer for the Philippine Islands. Mr. Osgood had charge of the work on the island of Culion and was surrounded by conditions peculiarly trying and exasperating. He accomplished as much as was possible and in so doing assumed considerable personal risk.

The commissioner of public health desires to thank the native physicians of Manila as well as his Spanish confrères for the courtesy and kindness they have shown him. He well realizes that the efficiency of any board of health is very largely dependent upon the good will and support of the medical faculty with which it comes in contact. To all who have assisted or encouraged him, both physicians and laymen, the commissioner of public health desires to extend his thanks, and particularly to the members of the clerical force, who have worked so faithfully, steadily, and loyally during the past year.

E. C. CARTER,
Major and Surgeon, U. S. Army,
Commissioner of Public Health.

STATISTICAL TABLES.

VITAL STATISTICS FROM SEPTEMBER 1, 1902, TO SEPTEMBER 1, 1903.

Population of Manila, official census of 1903.

Filipinos	189,782
Chinese	22,125
Foreigners	3,645
Americans	4,389
Total	219,941

Deaths, by race, occurring among residents from September 1, 1902, to September 1, 1903.

Filipinos	8, 142
Chinese	600
Foreigners	85
Americans	65
Total	8, 892

Stillbirths, 208.

City death rate per thousand, by race, from September 1, 1902, to September 1, 1903.

Filipinos	^a 43. 42
Chinese	^a 28. 26
Foreigners	^a 18. 72
Americans	^a 14. 80
Average	^b 37. 00

A classified report, by sex and condition, of all deaths occurring among residents and transients in Manila from September 1, 1902, to September 1, 1903.

MALES.		FEMALES.	
Married	1, 041	Married	869
Widowers	202	Widows	370
Single	1, 242	Single	393
Boys	2, 620	Girls	2, 274
Condition not stated in certificate.	300	Condition not stated in certificate.	83
Total males	5, 405	Total females	4, 197

Deaths with and without medical attendance occurring among residents and transients.

Number of deaths with attendance	4, 853
Number of deaths without medical attendance	4, 541
Total	9, 394

Two hundred and eight of above were stillbirths.

Deaths by districts, including transients.

District.	Popula- tion.	Deaths.	Rate per 1,000.
Walled city	11, 463	494	43. 09
Binondo	16, 613	602	36. 23
San Nicolas	29, 059	954	32. 82
Tondo	39, 045	2, 208	56. 55
Santa Cruz	35, 040	1, 426	40. 69
Quiapo	11, 149	590	52. 91
Sampaloc	18, 779	857	45. 63
San Miguel	8, 838	350	39. 60
Paco	6, 725	594	88. 32
Ermita	12, 226	235	19. 22
Malate	8, 858	258	29. 12
Pandacan	2, 990	175	58. 52
Santa Ana	3, 255	126	38. 70
Transient residents		502	.....
Unknown		23	.....
Total		9, 394	.....

Stillbirths, 208.

^a Death rates by race based on returns of official census, 1903.

^b Death rate for city based on board of health census to June 30, 1903, and on official census for July and August, 1903.

Deaths by age.

Under 30 days	874	51 to 60 years	501
30 days to 1 year	2,998	61 to 70 years	405
1 year to 2 years	414	71 to 80 years	209
2 to 5 years	398	81 to 90 years	113
5 to 10 years	200	91 to 100 years	71
11 to 15 years	135	101 years and over	28
16 to 20 years	265	Unknown	37
21 to 25 years	456		
26 to 30 years	624	Total	9,394
31 to 35 years	1,020	Stillbirths	208
41 to 50 years	646		

Rate of comparative mortality, city of Manila, by months, from January 1, 1900, to January 1, 1903.

Month.	1900.		1901.		1902.		1903.	
	Number of deaths.	Annual death rate per 1,000. ^a	Number of deaths.	Annual death rate per 1,000. ^a	Number of deaths.	Annual death rate per 1,000. ^a	Number of deaths.	Annual death rate per 1,000. ^a
January.....	1,055	50.79	753	36.25	760	36.58	602	28.98
February.....	884	47.11	689	36.72	706	37.63	511	27.23
March.....	887	42.70	885	42.66	770	37.06	539	25.94
April.....	805	40.04	886	44.07	1,327	66.01	549	27.31
May.....	732	35.24	903	43.47	1,688	81.26	770	37.06
June.....	599	29.79	621	30.89	1,418	70.54	592	29.45
July.....	787	37.88	608	29.27	2,223	110.09	620	b 33.21
August.....	825	33.71	702	33.79	1,712	82.42	862	b 46.17
September.....	1,027	50.01	767	38.15	1,132	56.31	.....	.....
October.....	961	46.23	855	41.16	927	44.62	.....	.....
November.....	976	48.48	848	42.18	1,035	51.48	.....	.....
December.....	905	43.64	858	41.30	753	36.25	.....	.....

^a Death rate computed on population of 244,732 (health department census).

^b Death rate computed on population of 219,941 (official census, 1903).

Number of deaths, with causes, occurring among transients in Manila, from September 1, 1902, to September 1, 1903.

[These deaths are not included in preparing death rate of city.]

No.	Diseases.	Americans.		Foreigners.		Filipinos.		Chinese.		Total.
		Male.	Fe- male.	Male.	Fe- male.	Male.	Fe- male.	Male.	Fe- male.	
I. General diseases.										
1	Typhoid fever.....	2				6	1	1		10
3	Recurrent fever.....					1				1
4	Intermittent fever.....					6	2	1		9
4 ^a	Malarial cachexia.....					4	3	1		8
5	Variola.....	2	1			1				4
12	Asiatic cholera.....	1	1	1		37	15	6		61
14	Dysentery.....	2	1			16	2	2		23
15	Plague.....		1			6	1	4		11
17	Leprosy.....					5	1			6
19	Other epidemic affections (beriberi).....					117	9	6		132
20	Purulent infection and septicæmia.....			2	1	1				3
27	Tuberculosis of lungs.....	2		2		39	13	5		61
29	Tuberculosis of abdomen.....	1								1
33	Tuberculosis of other organs.....							1		1
34	Generalized tuberculosis.....					3				3
35	Scrofula.....							1		1
45	Cancer and other malignant tumors of other organs and organs not spec- ified.....						1			1
48	Chronic rheumatism and gout.....						1			1
54	Anæmia.....					1	3			4
56	Acute alcoholism, or chronic.....	3		1		1				5

Number of deaths, with causes, occurring among transients in Manila, from September 1, 1902, to September 1, 1903—Continued.

No.	Diseases.	Americans.		Foreigners.		Filipinos.		Chinese.		Total.
		Male.	Fe-male.	Male.	Fe-male.	Male.	Fe-male.	Male.	Fe-male.	
	<i>II. Diseases of the nervous system and the organs of special sense.</i>									
61	Meningitis, simple		1			1	3			5
64	Cerebral congestion and hemorrhage.....					3	3	2		8
69	Epilepsy					1				1
70	Eclampsia (nonpuerperal).....					2	1			3
71	Convulsions of children.....					8	5			13
72	Tetanus.....					2				2
	<i>III. Diseases of the circulatory system.</i>									
77	Pericarditis							1		1
78	Acute endocarditis.....					7	1			8
79	Organic disease of the heart		1	1		4	1	4		11
80	Angina pectoris.....					2	2			4
81	Affections of the arteries (atheroma, aneurism, etc.).....					1				1
85	Hemorrhages							1		1
	<i>IV. Diseases of respiratory system.</i>									
88	Affections of the larynx.....					1	1			2
90	Acute bronchitis.....					2				2
91	Chronic bronchitis.....					1	6			7
92	Broncho-pneumonia.....					2	1			3
93	Pneumonia					20		1		21
95	Pulmonary congestion and apoplexy					1				1
96	Gangrene of the lungs.....					2				2
97	Asthma					1				1
98	Pulmonary emphysema.....					1				1
99	Other diseases of the respiratory system (phthisis excepted)					1				1
	<i>V. Diseases of digestive system.</i>									
104	Other affections of the stomach (cancer excepted).....						1			1
105 ^a	Diarrhea and enteritis chronic.....					4	1			5
107	Intestinal parasites.....					1				1
108	Hernias, intestinal obstructions					1		1		2
112	Cirrhosis of the liver.....		1	1		1				3
113	Biliary calculi					1				1
117	Other affections of the digestive system (cancer and tuberculosis excepted)					1				1
	<i>VI. Diseases of the genito-urinary system, and its adnexa.</i>									
119	Acute nephritis.....					3	1			4
120	Bright's disease.....			1		4	2	1		8
122	Calculi of the urinary tract.....					1				1
	<i>VII. The puerperal state.</i>									
135	Puerperal hemorrhage.....						1			1
137	Puerperal septicæmia						1			1
	<i>IX. Diseases of the organs of locomotion.</i>									
146	Affections of the bones (nontuberculous).....					1				1
	<i>XI. Early infancy.</i>									
151	Congenital debility, tetanus and scleroma						1			1
	<i>XII. Old age.</i>									
154	Senile debility				1	3	7	1		12
	<i>XIII. Affections produced by external causes.</i>									
155	Suicide by poison.....					1				1
160	Suicide by cutting instruments					2				2

Number of deaths, with causes, occurring among transients in Manila, from September 1, 1902, to September 1, 1903—Continued.

No.	Diseases.	Americans.		Foreigners.		Filipinos.		Chinese.		Total.
		Male.	Fe-male.	Male.	Fe-male.	Male.	Fe-male.	Male.	Fe-male.	
	XIII. Affections produced by external causes—Continued.									
164	Fractures	1								1
166	Other accidental traumatism			1		1				2
167	Burns							1		1
172	Accidental submersion					1				1
175	Other acute poisonings		1							1
176	Gunshot wounds received in action	1				1				2
	XIV. Ill-defined diseases.									
177	Dropsy					1				1
179	Unspecified or ill-defined causes of death					1	1			2
	Total	15	7	10	1	336	92	41		502

Deaths occurring in Bilibid Prison from September 1, 1902, to September 1, 1903.

Diseases.	Prison.		House of correction.				Total.
	Filipinos.		Filipinos.		Chinese.		
	Male.	Fe-male.	Male.	Fe-male.	Male.	Fe-male.	
Intermittent fever.....	1		1				2
Asiatic cholera.....	9		4		1		14
Plague.....	2						2
Beriberi.....	59		36				95
Dysentery.....	13		3				16
Septicæmia.....			1				1
Tuberculosis of lungs.....	16		11				27
Anæmia.....			1				1
Endocarditis.....	4		1				5
Organic disease of the heart.....	1						1
Acute bronchitis.....	1						1
Chronic bronchitis.....	1						1
Pneumonia.....	12		4				16
Gangrene of the lungs.....	1						1
Pulmonary emphysema.....			1				1
Asthma.....	1						1
Cedema of the lungs.....			1				1
Biliary calculi.....	1						1
Acute nephritis.....	4		2				6
Bright's disease.....			1	1	2		4
Senile debility.....	2						2
Dropsy.....				1			1
Strangulated hernia.....	1						1
Chronic rheumatism.....	1						1
Tuberculosis of abdomen.....			1				1
Total.....	130		68	2	3		203

Diseases.	Condition.							Cemeteries.	
	Single.		Married.		Wid- ower.	Unknown.		Loma.	Chi- nese.
	Male.	Fe- male.	Male.	Fe- male.		Male.	Fe- male.		
Organic disease of the heart.....	68	.....	121	2	10	2	.....	200	3
Total	68	.....	121	2	10	2	.....	200	3

These deaths included in yearly report.

Births reported from September 1, 1902, to September 1, 1903.

Race.	Male.	Female.	Total.
Filipinos	1,711	1,537	3,248
Chinese	8	13	21
Foreigners	40	31	71
Americans	28	19	47
Total	1,787	1,600	3,387

Annual birth rate per thousand for the year.

Race.	Rate per 1,000.
Filipinos	17.11
Chinese .....	.98
Foreigners	15.63
Americans	10.70
Average	15.39

Epidemic of cholera in the provinces of the Philippine Islands from April 1 to September 1, 1902.

Province.	Cases.	Deaths.	Province.	Cases.	Deaths.
Bataan	1,026	758	West Negros	63	44
Bulacan	1,263	863	Sorsogon	2	2
Pampanga	885	624	Union	2,704	2,124
Rizal	848	496	Albay	2	2
Camarines	933	693	Mindoro	254	233
Cavite	803	576	Marinduque	222	151
Ilocos Norte	1,410	984	Benguet	1	1
Ilocos Sur	1,060	701	Cebu	792	477
Laguna	2,519	2,096	Antique	17	10
Tarlac	260	198	Masbate	3	1
Pangasinan	4,276	3,019	Misamis	6	6
Batangas	3,049	2,430	Bohol	408	275
Samar	24	17	Iloilo	131	72
Tayabas	140	102	Cagayan	27	22
Zambales	424	291	Not stated	3,800	2,574
Nueva Ecija	906	749			
Leyte	284	235	Total	28,542	20,826

Epidemic of cholera in the provinces of the Philippine Islands from September 1, 1902, to September 1, 1903.

Province.	Cases.	Deaths.	Province.	Cases.	Deaths.
Bataan	5	4	Cebu	9,335	6,086
Bulacan	456	416	Antique	2,039	1,476
Pampanga	324	236	Masbate	494	290
Rizal	375	233	Misamis	4,474	2,388
Camarines	469	348	Bohol	2,082	1,437
Cavite	28	23	Iloilo	25,971	15,770
Ilocos Norte	277	230	Cagayan	806	566
Ilocos Sur	461	327	Capiz	4,310	2,791
Laguna	384	254	Mindanao	69	56
Tarlac	526	376	East Negros	1,136	861
Pangasinan	3,332	2,364	Panay	69	39
Batangas	300	217	Abra	88	47
Samar	1,367	1,328	Isabela	32	17
Tayabas	231	139	Romblon	200	74
Zambales	1,691	1,089	Surigao	798	534
Nueva Ecija	867	663	Nueva Vizcaya	1	1
Leyte	1,077	805	Jolo	26	21
West Negros	7,395	1,682	Zamboanga	273	136
Sorsogon	540	253	Rizal (Fort Wm. McKinley)	3	3
Union	1,142	733	Not stated	48,722	28,931
Albay	1,140	1,047			
Mindoro	54	46	Total	123,382	77,325
Marinduque	13	8			

Epidemic of cholera, by months, in the city of Manila and provinces, from March 20, 1902, to September 1, 1903.

Month.	Manila.		Provinces.	
	Cases.	Deaths.	Cases.	Deaths.
1902.				
March	108	90	.....	.....
April	586	406	1,927	1,417
May	550	442	2,407	1,631
June	601	492	5,204	4,097
July	1,368	1,053	7,757	5,807
August	720	581	11,247	7,874
September	273	179	43,346	27,410
October	87	57	30,837	18,572
November	336	236	12,353	6,681
December	35	24	5,918	3,583
1903.				
January	7	4	4,921	2,757
February	2	1	2,997	2,009
March	6	6	1,903	1,124
April	33	27	1,772	1,147
May	230	212	1,402	885
June	39	38	3,554	2,945
July	42	38	4,167	2,806
August	89	72	10,212	7,406
Total	5,112	3,958	151,924	98,151

Report of vaccinations, city of Manila, for the year September 1, 1902, to September 1, 1903.

District.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Total.
Intramuros	538	1,397	572	644	803	684	617	2,571	804	597	753	1,185	11,165
Binondo	633	2,150	1,294	1,101	2,779	2,448	1,892	2,483	1,467	1,092	1,788	548	19,675
San Nicolas	718	768	682	769	1,612	1,374	1,462	1,834	1,834	1,270	2,123	652	15,098
Tondo	1,445	2,111	718	539	1,647	1,784	4,200	2,223	5,481	1,814	2,434	1,089	26,485
Santa Cruz	1,671	873	657	658	1,489	1,221	1,146	1,541	1,854	1,545	1,465	584	15,004
Quiapo	1,641	920	498	466	1,480	1,226	1,171	1,566	1,508	1,291	2,889	632	15,294
San Miguel	682	1,002	674	549	779	563	557	1,444	707	721	1,163	586	9,427
Sampaloc	706	885	640	521	1,294	1,246	971	1,615	1,402	2,415	1,686	570	13,951
Paco	574	669	629	2,756	667	591	1,005	733	839	654	658	1,923	11,698
Ermita	437	681	191	310	798	561	479	706	627	603	684	693	6,770
Malate	154	362	341	295	666	1,003	795	908	765	1,005	730	340	7,364
Pandacan .....	.....	.....	.....	.....	679	391	222	.....	144	.....	.....	.....	1,436
Santa Ana .....	.....	.....	.....	.....	647	543	149	.....	.....	.....	.....	.....	1,339
Total	9,205	11,818	6,896	8,608	15,340	13,935	14,666	18,624	17,432	13,007	16,373	8,802	154,706

Report on vaccination, city of Manila, from September 1, 1902, to September 1, 1903.

District.	Children.			Adults.			Totals.			Grand total.
	Filipi- nos.	Chi- nese.	Ameri- cans and foreign- ers.	Filipi- nos.	Chi- nese.	Ameri- cans and foreign- ers.	Filipi- nos.	Chi- nese.	Ameri- cans and foreign- ers.	
Walled city	3,499	.....	29	6,662	544	431	10,161	544	460	11,165
Binondo	4,021	95	1	10,139	5,318	101	14,160	5,413	102	19,675
San Nicolas	4,177	29	1	6,359	4,507	25	10,536	4,536	26	15,098
Tondo	11,101	4	3	12,096	3,177	104	23,197	3,181	107	26,485
Santa Cruz	6,071	5	1	6,848	2,020	59	12,919	2,025	60	15,004
Quiapo	4,877	3	6	8,840	1,395	173	13,717	1,398	179	15,294
San Miguel	3,361	1	3	5,122	871	69	8,483	872	72	9,427
Sampaloc	5,488	.....	8	7,797	271	387	13,285	271	395	13,951
Paco	3,906	.....	4	7,514	246	28	11,420	246	32	11,698
Ermita	2,782	.....	4	3,770	194	20	6,552	194	24	6,770
Malate	3,216	1	.....	3,975	111	61	7,191	112	61	7,364
Pandacan	658	.....	.....	765	13	.....	1,423	13	.....	1,436
Santa Ana	721	.....	.....	609	9	.....	1,330	9	.....	1,339
Total	53,878	138	60	80,496	18,676	1,458	134,374	18,814	1,518	154,706

Report of vaccinations from September 1, 1902, to September 1, 1903, for the city of Manila.

	Total number vaccinated.	Result obtained.		Per cent.	
		Positive.	Negative.	Positive.	Negative.
1902.					
September.....	9,205	8,395	810	0.912	0.088
October.....	11,818	10,833	985	.916	.083
November.....	6,896	6,205	691	.899	.10
December.....	8,608	2,509	6,099	.291	.708
1903.					
January.....	15,340	4,340	11,000	.282	.717
February.....	13,935	2,362	11,573	.169	.83
March.....	14,666	2,361	12,305	.161	.839
April.....	18,624	6,608	12,016	.354	.645
May.....	17,432	6,783	10,649	.389	.611
June.....	13,007	5,551	7,456	.426	.573
July.....	16,373	7,990	8,383	.488	.511
August.....	8,802	3,671	5,131	.417	.582
Total.....	154,706	67,608	87,098	.436	.562

Recapitulation, vaccine report, from September 1, 1902, to August 31, 1903.

Institutions.	September.	October.	November.	December.	January.	February.
United States Army.....	1,885	2,000	2,400	5,110	4,700	9,070
United States Navy.....	800	2,200	1,200	.....	300	500
Inhabitants of Philippines, Manila not included.....	24,600	40,200	24,720	59,700	97,500	125,400
Public vaccinator.....	9,205	11,818	6,896	16,300	29,810	29,250
Public institutions.....	.....	.....	.....	.....	.....	1,425
United States Public Health and Marine-Hospital Service.....	.....	.....	.....	.....	700	.....
Philippine Civil Hospital.....	.....	.....	.....	.....	.....	.....
Bilibid Prison.....	.....	.....	.....	.....	.....	.....
Philippines constabulary.....	.....	.....	.....	.....	.....	.....
Sales to sundry persons.....	115	585	100	570	155	95
Total.....	36,605	56,803	35,316	81,680	133,165	165,740

Institutions.	March.	April.	May.	June.	July.	August.	Total.
United States Army.....	7,470	7,985	10,060	4,300	2,600	3,940	61,540
United States Navy.....	.....	.....	.....	.....	.....	500	5,500
Inhabitants of Philippines, Manila not included.....	111,200	158,900	90,955	40,600	52,400	22,000	848,175
Public vaccinator.....	28,000	26,000	24,000	12,370	20,000	16,000	229,649
Public institutions.....	1,575	1,535	.....	615	50	115	5,315
United States Public Health and Marine-Hospital Service.....	600	2,200	.....	.....	1,500	100	5,100
Philippine Civil Hospital.....	400	400	100	25	.....	100	1,025
Bilibid Prison.....	.....	1,000	.....	.....	100	.....	1,100
Philippines constabulary.....	.....	200	.....	.....	400	100	700
Sales to sundry persons.....	565	495	610	230	210	75	3,805
Total.....	149,810	198,715	125,725	58,140	77,280	42,930	1,161,909

Report of Chinese receiving primary and secondary inoculations against plague from board of health physicians May 11 to July 31, 1903.

Period.	Sanitary stations.									
	San Nicolas.		Binondo.		Quiapo.		Tondo.		Santa Cruz.	
	Primary inoculations.	Secondary inoculations.	Primary inoculations.	Secondary inoculations.	Primary inoculations.	Secondary inoculations.	Primary inoculations.	Secondary inoculations.	Primary inoculations.	Secondary inoculations.
May 11 to 31.....	465	6	426	.....	859	.....	944	.....	1,655	.....
June 1 to 30.....	304	345	271	242	138	304	229	808	303	241
July 1 to 31.....	223	87	.....	.....	.....	.....	287	211	5	2
Total.....	992	438	697	242	997	304	1,460	1,019	1,963	243

Report of Chinese receiving primary and secondary inoculations against plague from board of health physicians May 11 to July 31, 1903—Continued.

Period.	Sanitary stations.									
	San Miguel.		Sampaloc.		Intramuros.		Paco, Malate, Ermita.		Total for city.	
	Primary inoculations.	Secondary inoculations.	Primary inoculations.	Secondary inoculations.	Primary inoculations.	Secondary inoculations.	Primary inoculations.	Secondary inoculations.	Primary inoculations.	Secondary inoculations.
May 11 to 31.....	366	.....	502	.....	600	.....	105	.....	5,922	6
June 1 to 30.....	112	221	246	236	.....	600	100	.....	1,703	2,997
July 1 to 31.....	.....	.....	.....	.....	.....	.....	.....	.....	515	300
Total.....	478	221	748	236	600	600	205	.....	8,110	3,303

In addition to the above antiplague inoculations of Chinese were made by private physicians.

Reports received of lepers living in the various provinces of the Philippine Islands to August 31, 1903.

Province.	Number of men.	Number of women.	Children.		Single.		Married.		Widowers.	Widows.	Race.	Total.
			M.	F.	M.	F.	M.	F.				
Antique.....	92	37	2	2	38	28	42	4	12	5	Filipinos ...	133
Batangas.....	19	5	.....	.....	12	3	3	3	3	.....	do	24
Bataan.....	10	4	1	1	5	.....	3	2	2	2	do	16
Benguet.....	31	10	1	1	1	.....	21	10	9	.....	Igorrotes	43
Ambos Camarines.....	33	17	1	1	24	12	8	5	1	.....	Filipinos	52
Bulacan.....	17	9	2	1	12	6	5	3	.....	.....	do	29
Ilocos Norte.....	45	28	5	2	9	10	31	8	5	10	do	80
Ilocos Sur.....	176	84	4	2	101	50	66	17	14	12	do	266
Leyte.....	49	38	1	3	26	27	20	7	3	4	do	91
Masbate.....	51	35	25	10	22	15	23	19	2	5	do	121
Cagayan.....	46	30	.....	3	20	10	20	19	6	1	do	79
Lepanto.....	14	4	1	.....	5	1	8	.....	1	3	do	19
Cavite.....	17	5	.....	3	16	3	1	.....	.....	2	do	25
Nueva Ecija.....	44	24	.....	.....	19	12	22	8	2	5	do	68
Negros Occidental.....	26	11	5	1	17	10	8	1	1	.....	do	43
Pampanga.....	8	5	2	.....	3	1	5	3	1	.....	do	15
Pangasinan.....	120	80	2	3	36	28	65	38	19	14	do	205
Rizal.....	41	24	2	.....	19	12	21	7	3	3	do	67
Marinduque.....	1	1	1	.....	.....	1	1	.....	.....	.....	do	3
Laguna.....	1	.....	.....	.....	.....	.....	1	.....	.....	.....	do	1
San Lazaro ^a	93	77	22	9	59	38	26	24	9	15	do	202
Tarlac.....	27	24	11	4	7	9	17	11	2	5	do	66
Sorsogon.....	75	33	1	1	33	17	40	10	3	5	do	110
Romblon.....	5	10	.....	.....	3	6	2	3	1	.....	do	15
Samar.....	39	52	13	8	17	9	21	18	3	3	do	92
Union.....	43	28	3	.....	15	14	24	12	4	2	do	74
Zambales.....	58	35	2	.....	30	15	26	13	4	5	do	95
Mindanao.....	140	74	3	3	84	46	45	18	9	12	Moros	220
Cebu.....	171	89	5	4	136	64	33	21	3	3	Filipinos ...	269
Iloilo.....	231	66	11	2	113	37	94	9	24	20	do	310
Negros Oriental.....	66	42	6	2	27	23	32	14	7	5	do	116
Isabela de Luzon.....	18	4	1	.....	3	1	10	3	5	.....	do	23
Tayabas.....	1	.....	.....	.....	.....	.....	.....	.....	1	.....	do	1
Albay.....	68	33	1	1	30	18	27	10	11	5	do	103
Nueva Vizcaya.....	13	12	2	.....	7	3	4	6	2	3	do	27
Abra.....	11	6	.....	.....	5	4	5	2	1	.....	do	17
Bohol.....	46	46	5	1	20	19	27	17	3	6	do	98
Capiz.....	44	33	19	9	26	24	13	12	1	1	do	105
Total.....	1,990	1,025	160	77	1,000	576	820	357	177	156	.....	3,323

^a1 European female.

General inspection of houses, premises, and vaults, with improvements, ordered by medical inspectors, chief sanitary inspectors, and sanitary inspectors, from September 1, 1902, to September 1, 1903.

Houses inspected by the chief sanitary inspector	55, 913
Houses reinspected for verification of work ordered	21, 934
Houses inspected by sanitary inspectors	1, 470, 813
Houses reinspected by sanitary inspectors	406, 330
Houses ordered cleaned (written)	6, 623
Houses ordered cleaned (verbal)	143, 716
Houses cleaned	241, 806
Houses ordered whitewashed and painted	7, 813
Houses whitewashed and painted	1, 196
Houses disinfected	7, 336
Number of houses recommended condemned and removed	372
Number of houses condemned and removed	82
Number of localities where "squatters" are located	55
Number of samples of water sent to laboratory	8
Number of reports from same	7
Number of hydrants recommended reopened	26
Number of houses where garbage has not been removed for two days	6, 698
Number of persons reported sick to municipal physicians	4, 104
Cesspools and vaults ordered cleaned	14, 346
Cesspools cleaned	11, 256
Yards ordered cleaned	144, 389
Yards cleaned	161, 447
Yards ordered repaired (repaved, etc.)	3, 357
Yards repaired	1, 757
Number of cholera cases reported by sanitary inspectors	294
Number of cholera cases reported by auxiliary advisory board	92
Number of cholera cases found alive	270
Number of cholera cases found dead	264
Number of orders issued during the year	7, 545
Number of orders complied with during the year	5, 479
Number of orders awaiting action	4, 094
Number of orders pending in court	204
Number of food tiendas in district	1, 052
Number of persons convicted for violation of food prohibition order	246
Average in visiting each street and barrio during year	133. 39
Average number of regular inspectors on duty	33. 34
Average number of emergency inspectors on duty	101. 50
Number of leper cases sent to San Lazaro Hospital	46
Number of plague cases reported	185
Number of smallpox cases reported	71
Houses in which traps are set	59, 778
Houses in which bane is placed	33, 397
Traps set	139, 880
Plates with rat bane placed	104, 603
Rats caught by rat catchers	39, 047
Rats caught by traps	38, 089
Rats caught by poison	2, 931
Rats purchased	474
Average number of rat catchers employed	52. 5

Report of river and harbor sanitary work from October 1, 1902, to September 1, 1903.

Cascos, ships, and other craft inspected	42, 404
Cholera cases found alive	72
Cholera cases found dead	35
Cholera cases found on ships and other craft	19
Smallpox cases found on ships and other craft	15
Bubonic plague cases found on ships and other craft	9
Dead bodies found in river and harbor	21
Cascoes, ships, and other craft disinfected	93
Cascoes quarantined	2
Trips made by the board of health launch to the bay	35
Trips made by the board of health up the river	33
Rats caught on boats	13

Report of sick and wounded city poor attended by municipal physicians from September 1, 1902, to September 1, 1903.

Name of physician.	District.	Nationality of patients.							
		Children.		Adults.					
		Filipinos.		Filipinos.		Chinese.		Foreigners.	
		Boys.	Girls.	Male.	Female.	Male.	Female.	Male.	Female.
R. Perramon.....	Walled city.....	96	106	222	306	1	.....	4	.....
	Concepcion.....	26	33	46	91	.....	.....	.....	.....
	San Miguel.....	24	23	69	83	1	.....	1	.....
	Paco.....	92	110	204	229	.....	.....	.....	.....
C. Mora.....	Ermita.....	9	10	23	25	.....	.....	.....	.....
	Malate.....	38	37	89	107	.....	.....	.....	.....
C. Victorino.....	Santa Ana.....	7	5	27	38	.....	.....	.....	.....
C. Reyes.....	Quiapo.....	23	21	58	42	2	.....	.....	.....
	Santa Cruz.....	50	31	102	108	7	.....	1	.....
F. Castaneda.....	Sampaloc.....	144	122	335	406	1	.....	.....	.....
C. Victorino.....	Pandacan.....	15	5	49	30	.....	.....	.....	.....
S. V. del Rosario.....	Binondo.....	4	2	9	6	.....	.....	.....	.....
V. Pantoja.....	Tondo.....	63	53	127	140	5	.....	.....	.....
P. Gabriel.....	San Miguel.....	1	1	3	2	.....	.....	.....	.....
	Quiapo.....	1	.....	2	7	.....	.....	.....	.....
F. Castaneda.....	Pandacan.....	.....	1	4	4	.....	.....	.....	.....
C. Mora.....	Santa Ana.....	2	.....	7	9	.....	.....	.....	.....
V. Cavanna.....	San Nicolas.....	48	52	115	127	.....	.....	1	.....
Total.....		643	612	1,491	1,760	17	.....	7	.....

Name of physician.	District.	Nationality of patients.			Cured.		Deaths.		Number of visits.
		Adults.			Male.	Fe- male.	Male.	Fe- male.	
		Americans.		Total.					
		Male.	Fe- male.						
R. Perramon.....	{ Walled city.....	1		736	147	192	29	33	1,716
	{ Concepcion.....			196	31	48	8	16	481
	{ San Miguel.....			201	23	30	15	25	527
	{ Paco.....			635	69	86	82	77	1,468
C. Mora.....	{ Ermita.....			67	6	7	10	5	175
	{ Malate.....			271	39	28	26	43	625
C. Victorino.....	{ Santa Ana.....			77	17	25	11	8	220
C. Reyes.....	{ Quiapo.....			146	51	30	7	7	754
	{ Santa Cruz.....			299	101	67	9	17	1,642
F. Castaneda.....	{ Sampaloc.....			1,008	186	219	49	54	2,013
C. Victorino.....	{ Pandacan.....			99	30	28	10	5	278
S. V. del Rosario.....	{ Binondo.....			21			4	3	40
V. Pantoja.....	{ Tondo.....	1		389	63	71	61	54	950
P. Gabriel.....	{ San Miguel.....			7	2	1	2		11
	{ Quiapo.....			10	2	4	2		22
F. Castaneda.....	{ Pandacan.....			9	3	2	1	1	25
C. Mora.....	{ Santa Ana.....			18	3	8	3		42
V. Cavanna.....	{ San Nicolas.....	3		346	66	75	18	33	1,497
Total.....		5		4,535	839	921	347	381	12,486

Report of prescriptions filled at the municipal dispensary from September 1, 1902, to September 1, 1903.

District.	Adult.		Children.		Total.
	Male.	Female.	Boy.	Girl.	
Walled city.....	223	241	75	73	612
Concepcion.....	23	122	41	46	232
San Miguel.....	113	113	25	26	277
Ermita.....	57	58	3	15	133
Malate.....	106	109	20	23	258
Paco.....	212	295	52	41	600
Santa Ana.....	12	35	4	2	53
Sampaloc.....	853	862	323	196	2,234
Pandacan.....	55	42	7	.....	104
Quiapo.....	363	352	72	87	874
Santa Cruz.....	267	200	58	42	567
Binondo.....	102	114	35	24	275
San Nicolas.....	131	120	17	25	293
Tondo.....	62	70	3	11	146
Total.....	2,579	2,733	735	611	6,658

Burials from September 1, 1902, to September 1, 1903.

Paco general government.....	246	American National Cemetery.....	37
Loma.....	5,196	Chinese.....	648
Binondo.....	230	Sampaloc.....	1
Tondo.....	188	United States morgue, forwarded to United States.....	7
Santa Cruz.....	63	Crematory.....	385
Balibalic.....	1,209	San Pedro Macati.....	14
Malate.....	390	Forwarded to provinces.....	4
Maytubig.....	533		
Pandacan.....	235		
Santa Ana.....	216	Total.....	9,602

Disinterments from September 1, 1902, to September 1, 1903.

Paco cemetery (government).....	81	Malate.....	8
Loma cemetery (government).....	3	Santa Ana.....	1
Binondo.....	2	American National Cemetery.....	1
Tondo.....	45	Chinese cemetery for removal to China.....	304
Santa Cruz.....	64		
Balibalic.....	1	Total.....	513
Pandacan.....	3		

Inspections by veterinary division.

On arrival in city:

Number of—

Cattle inspected.....	35,964
Hogs inspected.....	51,538
Carabaos inspected.....	2,032
Sheep inspected.....	742
Goats inspected.....	619
Horses inspected.....	4,369
Other animals inspected.....	96

Total..... 95,360

In government abattoir:

Number of—

Cattle slaughtered.....	24,856
Hogs slaughtered.....	66,007
Sheep slaughtered.....	569
Goats slaughtered.....	10

Total..... 91,442

Number of—

Cattle condemned and cremated.....	52
Hogs condemned and cremated	244
Horses condemned for glanders and cremated	87
Horses condemned for surra and cremated	5
Horses condemned for psuedo-farcy and cremated	2
Other animals condemned and cremated	4
Total	394

DAVID G. MOBERLY, D. V. S.,
Veterinarian, Board of Health.

Report of crematory from September 1, 1902, to September 1, 1903.

ANIMALS CREMATED.

	Palomar.	Paco.	Santa Cruz.	Total.
Carcasses of chickens consumed.....		505	11, 670	12, 175
Carcasses of goats consumed.....	2	16	58	76
Carcasses of native horses consumed	2	580	513	1, 095
Australian horses		5		5
Carcasses of American horses consumed		212	84	296
Chinese ponies.....		12		12
Carcasses of mules consumed		176	25	201
Carcasses of carabaos consumed		206	116	322
Carcasses of cows consumed		256	295	651
Carcasses of dogs consumed	173	404	205	782
Geese		1		1
Carcasses of fowls consumed.....	664	254	4, 100	5, 018
Monkeys	2	4	82	88
Carcasses of cats consumed	94	42	1, 126	1, 262
Rabbits			16	16
Carcasses of rats consumed	2, 956	569	45, 091	48, 616
Sheep		9	7	16
Carcasses of pigs consumed	1, 426	57	971	2, 454
Birds.....	148	5	3, 349	3, 502
Cartloads of house refuse consumed		532	943	1, 475
Ducks	53	37	920	1, 010
Turkeys.....			116	116
Cartloads of bacon consumed (rotten)			6	6
Snakes			1	1
Hogs		74	390	464
Calves	2	26		28
Mules, Australian.....		6		6
Deer		2	8	10
Cartloads of refuse consumed.....			469	469
Total	5, 522	4, 090	70, 561	80, 173

LOADS CREMATED.

Street sweepings		772	1, 898	2, 670
Organic matter	235	137	50	422
House refuse		3, 022	7, 369	10, 391
Beef			4	4
Biscuits			6	6
Rice.....			3	3
Candy.....			2	2
Cushions, canvas.....			1	1
Other refuse.....	110	2, 314	195	2, 619
Refuse		332	123	455
Cheese			3	3
Beds, canvas			2	2
Flour			8	8
Rain coats, hats, etc			1	1
Hams			6	6
Tents, canvas			1	1
Military uniforms, discarded			4	4
Onions.....			1	1
Oranges.....			3	3
Potatoes.....			4	4
European edibles			32	32
Beans			2	2
Preserves			58	58
Garbage		2, 093	3, 393	5, 486
Jam			60	60
Provisions, European			8	8
Macaroni			1	1
Crackers			6	6
Military goods			4	4

Report of Crematory from September 1, 1902, to September 1, 1903—Continued.

LOADS CREMATED—Continued.

	Palomar.	Paco.	Santa Cruz.	Total.
Tobacco.....			6	6
Asparagus.....			9	9
Vegetables.....			1	1
Lemons.....			1	1
Matches.....			2	2
House garbage.....	2,211	1,505	802	4,518
Trade refuse.....	229			229
Market.....	29			29
Beach refuse.....			1	1
Total.....	2,814	10,175	14,070	27,059

Mortuary report from September 1, 1902, to September 1, 1903.

[illegible]

REPORT OF THE PHILIPPINE COMMISSION.

Mortuary report from September 1, 1902, to September 1, 1903—Continued.

Cause of death.	Americans.		Foreigners.		Filipinos.		Chinese.		Total.
	Male.	Fe-male.	Male.	Fe-male.	Male.	Fe-male.	Male.	Fe-male.	
I. General diseases—Continued.									
Cancer and other malignant tumors of other organs and organs not specified					3	4			7
Other tumors (tumors of the female genitals excepted)									
Acute articular rheumatism					2	3	1		6
Chronic rheumatism and gout					23	9			32
Scurvy					2	4			6
Diabetes						1			1
Exophthalmic goiter					1				1
Addison's disease									
Leukæmia					3	1			4
Anæmia, chlorosis	4		2		20	24	10		60
Other general diseases	1				2	3			6
Acute alcoholism, or chronic	4		2		1	2			9
Lead poisoning									
Other poisonings incident to occupations							1		1
Other chronic poisonings									
II. Diseases of the nervous system.									
Encephalitis					7	5			12
Meningitis, simple		1	3	1	133	135	2	3	278
Epidemic cerebro-spinal meningitis									
Progressive locomotor ataxia			1		3		2		6
Other diseases of the spinal cord					3	2	2		7
Cerebral congestion and hemorrhage	1		1	2	54	43	7		108
Cerebral softening			3		2	4	2		11
Paralysis without apparent cause									
General paralysis					13	16	3		32
Other forms of insanity							4		4
Epilepsy				1	1	3	1		6
Eclampsia (nonpuerperal)	1		1		346	297			645
Convulsions of children	1			1	1,105	925	3	3	2,033
Tetanus				2	58	46		2	106
Chorea						3			3
Other diseases of the nervous system					35	22			57
Diseases of the eye and its adnexa						1			1
Diseases of the ear									
III. Diseases of the circulatory system.									
Pericarditis					4	3			7
Acute endocarditis			1		23	23	4	1	52
Organic disease of the heart	4		1	1	44	44	27	1	122
Angina pectoris	1				30	56	4		91
Affections of the arteries (atheroma, aneurism, etc.)				1	16	17	4		38
Embolus and thrombosis					4	10			14
Affections of the veins (varices, hemorrhoids, phlebitis)					1	1			2
Affections of the lymphatic system (lymphangitis, etc.)									
Hemorrhages		1			2	2	1		6
Other affections of the circulatory system					1				1
IV. Diseases of the respiratory system.									
Diseases of the nasal fossæ					1				1
Affections of the larynx					33	26			59
Affections of the thyroid body									
Acute bronchitis			1	1	173	158	3	2	338
Chronic bronchitis			1		146	127	18		292
Broncho-pneumonia					12	16	1		29
Pneumonia	2				18	16	4		40
Pleurisy			1		3	5			6
Pulmonary congestion and apoplexy				1	17	13	2		33
Gangrene of the lungs									
Asthma					15	7	5		27
Pulmonary emphysema	1		1		2	3			7
Other diseases of the respiratory system (phthisis excepted)					2				2
V. Diseases of the digestive system.									
Affections of the mouth and its adnexa						2			2
Affections of the pharynx					3				3

Mortuary report from September 1, 1902, to September 1, 1903—Continued.

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REPORT OF THE PHILIPPINE COMMISSION.

Mortuary report from September 1, 1902, to September 1, 1903—Continued.

Cause of death.	Americans.		Foreigners.		Filipinos.		Chinese.		Total.
	Male.	Fe-male.	Male.	Fe-male.	Male.	Fe-male.	Male.	Fe-male.	
X. Malformations.									
Congenital malformations, stillbirths excepted.....					18	10			28
XI. Early infancy.									
Congenital debility, tetanus and sclerema.....			1	1	73	55			130
Otherspecial diseases of early infancy.....					6	4			10
Lack of care.....					1	2			3
XII. Old age.									
Senile debility.....			1		50	127	9		187
XIII. Affections produced by external causes.									
Suicide by poison.....									
Suicide by asphyxia.....									
Suicide by hanging or strangulation.....							1		1
Suicide by submersion.....									
Suicide by firearms.....	2		1		2	1			6
Suicide by cutting instruments.....					3		4		7
Suicide by jumping from high place.....									
Suicide by crushing.....									
Other suicides.....					1				1
Fractures.....	1				7		4		12
Dislocations.....									
Other accidental traumatisms.....					9	1	8		18
Burns.....					7	10	1		18
Burning by corrosive substances.....			1						1
Insolation.....									
Freezing.....									
Electrical shocks.....					1		1		2
Accidental submersion.....	3		1		16	3	2		25
Inanition.....	2				23	13			38
Inhalation of deleterious gases (suicide excepted).....					2				2
Other acute poisonings.....	1				1	1			3
Other external violence.....					4		1	1	6
XIV. Ill-defined diseases.									
Dropsy.....					1	1			2
Sudden death.....					2	2	1		5
Unspecified or ill-defined causes of death.....	1				19	7	4		31
Nomenclature of causes of death (intra-uterine).									
Diseases of the mother.....									
Syphilis.....									
Other general diseases.....									
Predisposition of abortion.....									
Albuminuria and other diseases incidental to pregnancy.....									
Traumatism and excess of work.....									
Diseases of the placenta and its membranes (corion, etc.).....									
Diseases of the fetus.....									
Malformation (hydrocephalus, etc., premature birth, etc.).....									
Accidents of labor.....									
Malformation of the mother.....									
Faulty presentation of the child.....									
Prolapse and compression of the cord.....									
Asphyxia.....									
Other not classified diseases.....									
Causes not classified, or unknown.....									
Total.....	58	7	62	23	4,307	3,835	576	24	
Grand total.....	65		85		8,142		600		8,892

Report of vaccine virus distributed by the board of health from September 1, 1902, to August 31, 1903.

Islands and provinces.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	July.	August.	Total.
ISLAND OF BOHOL.													
Province of Bohol								2,000			2,000		4,000
ISLAND OF CEBU.													
Province of Cebu				7,000	10,000	7,000	5,000	5,000	6,000		3,000	500	43,500
ISLAND OF CUYO.													
Province of Cuyo						1,000	2,000	2,000	2,000	2,000			9,000
ISLAND OF LUZON.													
Province of—													
Abra				5,000		10,000	15,000						30,000
Albay		4,000			6,000	5,000		4,200	5,000	2,500		1,000	27,700
Bataan			500	2,000			1,000	2,000	500	1,000	4,000		11,000
Batangas			3,000			2,500		1,500	2,000				9,000
Benguet	3,000	1,000			6,000			3,000	4,000		2,000	1,000	20,000
Bontoc									455	500		500	1,455
Bulacan	8,000	8,000	5,000	5,000	4,000	5,000	2,000	5,000	4,000	2,000	2,000	2,000	52,000
Cagayan					3,000		3,000	21,000	7,500	1,000	3,000	1,000	39,500
Camaringes Sur					40,000			11,000					51,000
Cavite	3,000				3,000	3,000	3,000	2,000			1,000		15,000
Ilocos Norte					2,000	2,300	2,000	10,000	500				16,800
Ilocos Sur			500	500			3,000	1,000	2,000	1,000			8,000
Isabela	1,000		2,000					3,500	500		1,000	6,000	14,000
Laguna	1,800				6,000	10,000	5,000	8,000					30,800
Nueva Ecija		4,000			5,000		7,000		2,000	1,000	5,000		24,000
Nueva Vizcaya							400						400
Pampanga		1,000	2,200	800		300	2,200	9,400	3,100	2,000	700	500	22,200
Pangasinan	1,000	3,000	2,020	2,000		6,000	1,000	4,000	1,000	5,000		1,000	26,020
Rizal		1,000	300		2,000	9,300	11,100	8,800	6,400	100	1,700		39,700
Sorsogon		1,000		5,000		2,000	18,000	5,000					31,000
Tarlac		2,000	1,000	700		4,000	2,000	6,000	4,000	4,000	2,000		25,700
Tayabas	2,000		600				4,000	3,000	7,000				16,600
Union		3,000			6,000	3,000	4,000	10,000			2,000		28,000
Zambales			1,000	5,000	2,000	8,000		5,000					21,000
CITY OF MANILA.													
Chief vaccinator of the vaccine institute	9,205	11,818	6,896	16,300	29,810	29,250	28,000	26,000	24,000	12,370	20,000	16,000	229,649
Sanitary stations, schools, and other institutions						1,425	1,575	1,535		615	50	115	5,315
ISLAND OF LEYTE.													
Province of Leyte						3,000							3,000
ISLAND OF MARINDUQUE.													
Province of Marinduque	2,000												2,000
ISLAND OF MASBATE.													
Province of Masbate	2,500					1,000	2,000	2,000	2,000	2,000	2,000		13,500
ISLAND OF MINDANAO.													
Province of—													
Cotabato				5,000		5,000	500						10,500
Misamis		2,000		2,700	2,000	5,000		1,000		4,000		1,000	17,700
Surigao				10,000		14,000				2,000			26,000
ISLAND OF MINDORO.													
Province of Mindoro			1,000			2,000	2,000	4,000	9,000	6,000	6,000		30,000

Report of vaccine virus distributed by the board of health from September 1, 1902, to August 31, 1903—Continued.

Islands and provinces.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	July.	August.	Total.
ISLAND OF NEGROS.													
Province of—													
Occidental Negros	100	2,000	.....	.....	500	.....	2,000	1,500	3,000	.....	2,500	2,500	14,100
Oriental Negros	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	500	.....	500
ISLAND OF PANAY.													
Province of—													
Antique	.....	.....	.....	2,000	.....	.....	2,000	1,000	3,000	.....	.....	.....	8,000
Capiz	.....	.....	500	2,000	.....	.....	5,000	3,000	2,000	.....	1,000	5,000	18,500
Iloilo	3,200	5,200	100	5,000	.....	10,000	7,000	14,000	13,000	2,500	6,500	.....	66,500
ISLAND OF ROMBLON.													
Province of Romblon	.....	.....	.....	.....	.....	.....	.....	.....	.....	2,000	2,000	.....	4,000
ISLAND OF SAMAR.													
Province of Samar	.....	.....	5,000	.....	.....	10,000	.....	.....	2,000	.....	2,500	.....	19,500
SALES TO PUBLIC INSTITUTIONS.													
Medical supply depot, United States Army	1,885	2,000	2,400	5,110	4,700	9,070	7,470	7,985	10,060	4,300	2,620	3,940	61,540
United States naval station, Cavite	800	2,200	1,200	.....	300	500	.....	.....	.....	.....	.....	500	5,500
United States Public Health and Marine Hospital Service	.....	.....	.....	.....	700	.....	600	2,200	.....	.....	1,500	100	5,100
Bilibid prison	.....	.....	.....	.....	.....	.....	.....	1,000	.....	.....	100	.....	1,100
Civil hospital	.....	.....	.....	.....	.....	.....	400	400	100	25	.....	100	1,025
Philippines constabulary	.....	.....	.....	.....	.....	.....	.....	200	.....	.....	400	100	700
Cash sales	115	585	100	570	155	95	565	495	610	230	210	75	3,805
Grand total	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,161,909

REPORT OF THE CHIEF HEALTH INSPECTOR FOR THE PHILIPPINE ISLANDS.

DEPARTMENT OF THE INTERIOR,
BOARD OF HEALTH FOR THE PHILIPPINE ISLANDS,
OFFICE OF THE CHIEF HEALTH INSPECTOR,
Manila, P. I., September 1, 1903.

SIR: I have the honor to submit herewith report for the year beginning September 1, 1902, and ending August 31, 1903.

The duties of the office of chief health inspector for the Philippine Islands were assumed by the present incumbent on September 6, 1902.

The board of health then maintained and operated in Manila 12 health and sanitary stations, 4 cholera hospitals, 2 corrals, and 1 municipal free dispensary. The health and sanitary stations were located, 2 in the district of San Nicolas (1 for city, the other for river, water front, and harbor service), and 1 each in the districts of Tondo, Binondo, Santa Cruz, Quiapo, San Miguel, Sampaloc, Intramuros, Ermita and Malate, Paco, and Santa Ana. Each station has an average complement of 1 medical inspector, 1 district chief sanitary inspector, 6 sanitary inspectors, 5 special sanitary inspectors (American), and 10 special sanitary inspectors (Filipinos), and 2 market and water inspectors.

The cholera hospitals were located as follows: The Santiago Cholera Hospital of 125 beds on Calle Herran, Ermita; the San Lazaro Cholera Hospital of 100 beds at San Lazaro; the Tondo Cholera Hospital of 50 beds on Calle Galangnin, Tondo; the Pandacan Cholera Hospital in that part of the district of Paco known as "Pandacan." These hospitals were well equipped, and had their complement of physicians,

nurses, and attendants. The corrals were located, 1 in the district of Intramuros, the other at San Lazaro. They maintained an ambulance and disinfecting service. The Municipal Free Dispensary was located on Calle Santa Rosa, district of Quiapo.

During the month of September, 1902, there occurred in the city of Manila 11 cases of cholera among Americans, 236 cases among Filipinos, 5 cases among Europeans and Asiatics, other than Chinese, and 23 cases among Chinese, a total of 275 cases, with a mortality of 68.72 per cent. No cases of plague or smallpox occurred. The total mortality in Manila for this month from all causes was 45.61 per 1,000.

HEALTH AND SANITARY STATIONS.

The number of health stations then maintained being greater than necessary, the health stations at Santa Ana, Pandacan, and in Ermita and Malate were abolished, and the work in these districts assumed by the health station in Paco. The station in Intramuros, then separate and in a rented building, was removed to the central office of the board of health. The station in San Nicolas, in a rented building, was removed to the river and harbor station, which occupied a part of the police station, without rent, and a combination effected. Later, the entire city was redistricted for sanitary purposes to facilitate station work and equalize distances, which under the Spanish division was difficult to cover from a given station. At present there are 7 health districts covering the entire city and suburbs, with 7 stations, as follows:

Station A controls the district of San Nicolas and Binondo; is also station for river and harbor work, and is now known as "Health district No. 1."

Station C controls the district of Tondo, and is now known as "Health district No. 2."

Station F controls a part of the districts of Quiapo, San Miguel, and Sampaloc, and is now known as "Health district No. 3."

Station G controls the districts of Santa Cruz, Trozo, and a part of Quiapo, and is now known as "Health district No. 4."

Station I controls the greater part of the district of Sampaloc and the barrios extending in the direction of Santa Mesa, and is now known as "Health district No. 5."

Station J controls the district of Intramuros and a part of the districts of Ermita and Paco, and is now known as "Health district No. 6."

Station L controls the district of Malate and part of the districts of Ermita, Paco, Pandacan, Santa Ana, and Pasay.

These stations are thoroughly equipped as to personnel, which consists of a medical inspector, a district chief sanitary inspector, and an average of seven sanitary inspectors. All emergency sanitary inspectors, both American and Filipino, were discharged on July 31, 1903. In addition, all stations are equipped with office furniture, records, disinfectants, disinfecting carts (with disinfectors), telephone, and police service. Formerly the municipal physicians and midwives employed by the board of health to render gratuitous medical service to the poor were not under station control and an imperfect record was kept of their service. At present each station has assigned to it a municipal physician and one midwife. The municipal physician, in addition to his other duties, acts as assistant to the medical inspector; his work is recorded at the station, and a transcript furnished the office of the board of health. The service rendered by midwives is recorded in a register prepared for the purpose, and in view of the excessive infantile mortality among the poor, the study of parturition and feeding is now in progress with a view to, if possible, reducing the present high mortality.

Definite instructions relative to district health work have been issued covering all emergencies, so that now stations are able to handle conditions as they arise promptly and intelligently.

Station work for the year.

Houses cleaned.....	241, 398
Houses whitewashed and painted.....	1, 187
Houses condemned and removed.....	82
Cesspools and vaults ordered cleaned.....	14, 767
Yards cleaned.....	161, 247
Yards repaired.....	1, 756
Rats caught by rat catchers.....	37, 888
Rats caught by traps.....	36, 962
Rats caught by poison.....	2, 797
Rats purchased.....	494
Cholera cases reported or transferred to hospital.....	5, 112
Plague cases transferred to hospital.....	198
Smallpox cases transferred to hospital.....	97

HOSPITALS.

The reduction in the number of hospitals and the concentration of hospital work was effected in December. The Santiago Cholera Hospital, the Pandacan Cholera Hospital, and the Tondo Cholera Hospital were abolished. The San Lazaro Hospital was removed to one of the detention buildings within the San Lazaro inclosure, reorganized, and increased to 150 beds. Formerly the San Lazaro Hospital proper was composed only of a leper and women's departments, and without a physician in immediate charge. The plague and smallpox hospital was maintained as a separate institution under a native physician, and the morgue and crematory were still other separate institutions. The lack of system and organization was manifest; practically no records were kept and little was known of treatment and results. Realizing the importance of this work the chief health inspector selected Dr. H. B. Wilkinson to assume charge of all the San Lazaro institutions, and upon recommendation he was appointed and assumed charge on March 3, 1903. The steam disinfecting plant, then located near the Bridge of Spain on the Pasig River, was never used by reason of its distance from the hospital. This was removed to San Lazaro and the whole institution placed under one management, comprising the following departments: Leper, woman's, plague, smallpox, cholera, detention, morgue, crematory, and steam disinfecting plant. An appropriation was secured, a new system of lavatories, baths, and drains installed in the women's department, which had long been a source of continuous trouble.

The Santa Cruz fire of May 19 destroyed the cholera hospital and the five remaining detention buildings. By heroic effort on the part of Doctor Wilkinson and his assistants all cholera patients were saved, and a temporary hospital opened in two small nipa buildings in the inclosure which had escaped destruction. The accommodations were supplemented by the use of tents. The rainy season being due, the chief health inspector combined the cholera hospital with the plague and smallpox hospital on May 25. Since that date this hospital has handled practically all cholera, plague, and smallpox cases occurring in Manila, and by due care infection has not been transmitted from one department to another, although at times the institution has been taxed to its utmost capacity. On the morning following the Santa Cruz fire, the commissioner of public health, on request of the chief health inspector, wired the Commission then at Baguio, for an appropriation to immediately build a modern hospital for infectious diseases, within the San Lazaro inclosure. The request was promptly granted, plans and specifications drawn, contract let, and a new hospital is now nearing completion. Due to the interest manifested in the San Lazaro institutions by Doctor Wilkinson, many valuable and necessary changes have been made. A new roadway has been partially completed from the front of the hospital leading to the storehouse. This also will be the roadway in part leading to the new hospital upon its completion. The idea in view is to abolish all entrances to San Lazaro inclosure, except the main entrance; thus reducing the number of gate guards and placing the institution under more direct control. The grounds in the inclosure are being leveled, trees and flowers planted, and other improvements are contemplated with a view of making the institution attractive. The personnel of all the departments have been increased in efficiency, trained nurses have been employed, careful records have been kept, and systematic treatments have been inaugurated. The serum treatment for plague has become a routine procedure, and has been attended with excellent results.

Hospital work for the year—

Women's department:

Cases received for the year.....	1, 167
Cases discharged cured.....	1, 049
Cases discharged uncured.....	16
Cases transferred.....	28

Leper department:

Cases on hand September 1, 1902.....	185
Cases received during the year.....	91

Total.....	276
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Plague department:

Cases admitted.....	45
Deaths.....	32

Smallpox department:

Cases admitted.....	95
Deaths.....	12

Cholera department:

Cases admitted.....	385
Deaths.....	262

MORGUE.

The new morgue was occupied in July, 1903, greatly relieving the difficulties and inconveniences experienced in the improvised tent morgue formerly occupied. The new morgue is a modern structure with a capacity of 50 bodies. It has concrete floors; is well drained. The dead shelves are steel frame with tops of marble. Two post-mortem tables similarly constructed are conveniently located with reference to light and sinks.

Morgue work for the year.—Bodies received, 1,044; autopsies held March 1 to August 31, 1903, 177. No record prior to March 1, 1903.

CREMATORY.

When the new crematory is completed, which will adjoin the morgue, the handling of bodies for cremation will be greatly facilitated. The demands upon the old crematory have been very great and it is now in bad repair. The number of bodies cremated have greatly decreased since the municipal board of Manila has made a contract for the interment of bodies of the poor, gratis upon request of the family or friends.

Crematory work for the year.—Bodies cremated, 390.

CORRALS.

In September, 1902, the corral in the district of Intramuros was removed and combined with the San Lazaro corral. The enormous amount of work required of this corral in transferring cholera cases to the hospital, bodies dead from infectious diseases both night and day to the morgue, maintaining disinfecting, delivery, and pail-system service naturally depreciated the animals and rolling stock, which were limited in number. Little time could be given to repairs. A cessation came with cholera and other demands in May. The animals were resting up and the rolling stock undergoing repairs when, on the 19th of the month, the Santa Cruz fire entirely destroyed the corral and all rolling stock except two ambulances, two escort wagons, the disinfecting wagons, three pail-system drays, and two excavators. All animals and harness were saved. Six ambulances were immediately secured from the quartermaster's department of the army, which were subsequently purchased, and the corral service was maintained practically without interruption. As opportunity presented all ambulances, dead wagons, and carretellas have been repaired and repainted, so that now an ambulance, dead-wagon, disinfecting, and delivery service is maintained which in point of service and appearance is probably not equaled by any city in the Orient.

Ambulance service.—Six ambulances, with drivers and attendants, are kept in readiness to respond to calls night and day, and even when cholera reached its highest mark the cases were handled with little delay.

Dead-wagon service.—Two dead wagons, with drivers and attendants, are also kept in readiness to respond to calls night and day. Frequently, however, the demands have been so great that ambulances have been used to supplement the service.

Disinfecting service.—The importance of disinfecting can not be overestimated. The Filipinos engaged in this work have been carefully trained, and each crew, of which there are three, is under an experienced American, the whole being under a chief disinfecter, who by examination and experience of more than one year has demonstrated his ability to direct the work. The disinfecting service is now so well organized and so thorough in its operations that seldom can cases of infectious diseases be traced to a previous case. However, this method of disinfecting has faults which only a mobile steam disinfecter can correct.

Delivery service.—One light delivery wagon is assigned to the storehouse and is used daily to transport to stations, hospitals, and dispensary their necessary supplies, such as drugs, chemicals, disinfectants, etc. One escort wagon is kept at the corral for transporting heavy property, such as tentage, case disinfectants, pail-system supplies, etc.

Pail-system service.—All land transportation of the pail conservancy system is maintained and operated from the corral. This service, by virtue of the demand made upon it, particularly by public institutions and public closets, has been frequently taxed beyond its capacity. Additional trucks, excavators, and pumps are badly needed.

The service rendered by the corral during the year: Ambulances, 474 cases infectious diseases and 119 contacts transferred; dead wagons, 773 bodies transferred; disinfecting wagons, 6,090 houses disinfected; excavators, 1,500 loads night soil; trucks, 270,000 pails.

STOREHOUSE.

In September, 1902, the board of health had neither storehouse nor property clerk. The property was badly scattered and no returns were made by those having property in their charge. The lower part of one wing of the leper department was fitted up for a storehouse, a property clerk was appointed, and all property listed and that not in use repaired and stored. Property journals, blank requisitions, memorandum receipts, delivery blanks, etc., were printed, and a system of delivery service instituted. Now there is no delay in furnishing supplies to all departments of the board of health upon duly approved requisitions, when the same is in stock.

UNIFORMS ADOPTED.

In May, the chief health inspector designed a simple yet neat and inexpensive uniform of linen material for board of health employees operating among the public. This uniform was adopted by the board of health and went into effect on August 1, 1903. In addition to the uniform, a numbered badge is required to be worn. Sanitary inspectors (both American and Filipino), ambulance drivers and attendants, and disinfectors are now uniformed, and apparently a greater interest is manifested in the service than formerly. The adoption of the uniform has unquestionably proven advantageous.

MUNICIPAL FREE DISPENSARY.

In September, 1902, the municipal free dispensary occupied a rented building near the end of Calle Santa Rosa, in the district of Quiapo, a location not public and besides difficult to find. The service rendered by this dispensary was not what it should have been, and one reason, at least, could be attributed to its location. A part of the building occupied by health station F, on Plaza Quiapo, about the center of the city, and in a very public location, was secured and the dispensary removed; also its personnel was changed. In its new location the medicines dispensed to the poor have greatly increased. The service intended of the institution is now rapidly materializing. Two additional free dispensaries have been authorized. The chief health inspector has recommended that one be located in Tondo and the other in Paco.

RIVER, WATER FRONT, AND HARBOR SERVICE.

This service is operated from Station A, health district No. 1. A steam launch is rented and is in charge of the medical or sanitary inspector, who makes regular inspections of all cascos, launches, and smaller craft in the river, on the water front, and in the bay. All suspicious or infectious diseases found aboard crafts are brought ashore and sent to the hospital, the vessel disinfected, and the proper precautionary measures taken with those left aboard. In addition, the launch, with a medical officer, responds to calls of sick flags aboard vessels.

Infectious diseases found aboard sea-going vessels, either by the medical inspector or by the Marine-Hospital Service quarantine officers, are transferred to the board of health launch for disposition. The service rendered by this launch has been extensive and valuable, and in view of the great number of crafts from interisland ports and river towns, to which can be traced the transmission of cholera, smallpox, and probably plague infection, this service is indispensable.

METHODS DIRECTED TO THE IMPROVEMENT OF SANITARY CONDITIONS AND TO FREE MANILA OF INFECTIOUS DISEASES.

Sanitary inspections.—A regular system of sanitary inspections of houses, interiors, canals, outhouses, cesspools, vaults, latrines, etc., has been in operation for many months. This work is now better systematized and perfected than ever before. Definite rules govern all inspections.

Correcting insanitary conditions.—Orders are issued on the owner or agent of property by district chief sanitary inspectors on approval of the medical inspector and sanitary engineer for the city of Manila, in the name of the board of health, directing that within a given time the necessary sanitary improvements shall be made. If the same is not complied with the party concerned is brought before the police court and the case tried on its merits. By this method thousands of shockingly insanitary conditions have been corrected, all tending to improve Manila, reduce mortality, and better the conditions of all classes.

Inspection for sick of infectious diseases.—In conjunction with sanitary inspections a careful lookout is made for infectious diseases. All suspicious cases are brought to the attention of the medical inspector for diagnosis and disposition.

PREVENTIVE INOCULATION AGAINST PLAGUE.

The proximity of Manila to Hongkong and other Chinese ports and the constant danger of introducing new plague infection has caused an activity in plague work probably greater than in any previous year, together with the inauguration of more radical measures. The Chinaman being the principal agent for transmission of plague infection, the serum prevention method by inoculation has for the second year been inaugurated and has given results almost beyond expectation. This year practically all the coolie classes of Chinese in Manila received the primary and secondary inoculations of one and 2 c. c., respectively, of Shiga's prophylactic serum, and it only requires a comparison of the Manila plague report to that of Hongkong to determine the value of this measure. No bad results have ever been recorded from inoculations.

RAT CATCHING.

The conveyance and harboring of plague infection by rats and fleas has warranted the continuation of the rat crusade, which was begun in January of this year with improved methods and better trained rat catchers. The number of rats destroyed has been greater this year than ever before.

RIVER, WATER-FRONT AND HARBOR WORK.

This service, in addition to inspecting and removing infectious diseases, has been actively engaged in fumigating crafts for the destruction of rodents. Hundreds of vessels have thus been ridden of the rat pest, and in all probability many sources of plague infection have been correspondingly removed.

DISINFECTION.

The disinfecting service not only disinfects houses in which infectious diseases occur, but all insanitary localities, such as drains, cesspools, latrines, etc., receive attention. It also disinfects stables from which animals infected with surra, glanders, rinderpest, and foot and mouth diseases, have been removed. The steam disinfecting plant at San Lazaro disinfects clothing, bedding, etc., from the hospital, and such other articles from districts as required and which can be safely and conveniently transported.

INVESTIGATION AS TO CONTINUED PRESENCE OF CHOLERA IN MANILA.

All medical inspectors were in February directed to carefully study the source of infection so far as possible, of each cholera case coming under their supervision. After three months, special reports were required on the result of their investigation. It is interesting to note that the consensus of these investigations show that practically all cholera cases can be traced definitely to food and drink. The class of foods to which infection could be traced were those taken from the river and esteros, and also those much handled during the process of barter and sale. Infected water and drinks, composed principally of such water, were reported as being responsible for the other proportion of infection.

PROCEDURES IN VOGUE REGARDING THE DISPOSITION OF PERSONS INFECTED WITH PLAGUE, CHOLERA, AND SMALLPOX; ALSO CONTACTS TO THESE DISEASES.

No plague cases are permitted to be treated in private or public houses. All such cases are transferred to the plague hospital and the contacts are disinfected and inoculated with prophylactic plague serum. Cholera cases may be treated in private houses by physicians, provided the proper precautionary measures can be and are taken; otherwise, these cases are sent to the cholera hospital. Contacts to cholera cases are disinfected only. Smallpox cases are not permitted to be treated at their

homes; all such cases are sent to the smallpox hospital; however, there is no objection to private physicians treating plague, cholera, or smallpox in these hospitals, provided the rules of the institution are complied with. Contacts to smallpox cases are disinfected and vaccinated.

PROVINCIAL HEALTH INSPECTIONS.

In February, the islands were divided into six provincial health districts and six medical inspectors of the board of health were sent under orders, one to each district, consisting of several provinces. These physicians were instructed to inspect, instruct, and organize, if necessary, all provincial and municipal boards of health, also to study the hygienic and sanitary conditions as found, the diseases common in the locality, the average death rate and principal causes, the history of cholera, the customs and habits of the people relative to health and sanitation, and the diseases among cattle. A number of very interesting and instructive reports were rendered and much valuable information, statistical and otherwise, secured for the use of the board of health.

CHOLERA WORK IN THE PROVINCES OF SORSOGON AND ALBAY.

In March, reports were received that the spread of cholera in the provinces of Sorsogon and Albay had assumed serious proportions, and that the situation was further embarrassed by the fact that the constabulary was engaged in active operations against the ladrone element. By direction of the civil governor, the chief health inspector proceeded to these provinces, accompanied by two medical and two chief sanitary inspectors, and two 60-bed field hospitals, disinfectants, medical and hospital supplies, and assumed charge of health work. In the province of Sorsogon, the principal point of infection was the town of Donsol, situated on the west coast, north of the capital of the province. With one medical and one sanitary inspector and one 60-bed hospital and supplies, this town was visited, the conditions were found to be serious, a hospital was established, precautionary measures instituted, and within a short time the situation was under control. Then, with the other inspectors, hospital, and supplies, the province of Albay was visited, and the situation was found to have been exaggerated; however, cholera existed in several towns of the provincial capital. All of these towns were visited, board-of-health organizations effected, medicines and disinfectants distributed, and by the 1st of May the situation was so favorable as to warrant the return of the chief health inspector to Manila and later the return of his assistants, cholera having completely disappeared.

OPERATIONS IN THE MARIQUINA VALLEY.

The Manila water supply is taken from the Mariquina River, which drains practically the entire Mariquina Valley, in which some 10,000 people live. In June, the reports from three of the towns in the valley indicated that cholera was spreading. By direction of the board of health, the chief health inspector visited these towns, and upon his recommendation a medical inspector, with assistants, disinfectors, etc., was placed in charge of health conditions throughout the valley. The work was organized similar to that in Manila. Careful inspection and disinfection were inaugurated in each of the three towns above the water intake, and after five weeks of this service the cholera report was reduced from 10 to 15 cases daily to none. However, the danger of infecting the Manila water supply will always remain until a change is made in the present system.

HEALTH PUBLICATIONS.

It is the purpose of the chief health inspector to compile from time to time, in the form of health bulletins, treatises on the more important diseases met with in the Philippine Islands, for the information and guidance of medical inspectors and provincial and municipal health officials.

The first of these publications came out in May, entitled "Infectious Diseases in the Philippine Islands, Period of Incubation, Quarantine, Infection and Sources of Infection."

The second, entitled "Asiatic Cholera in the Philippine Islands, Distribution and Sources of Infection, Ætiology, Morbid Anatomy and Pathology, Symptoms, Diagnosis and Treatment.—Prevention.—Rules for observance on the occurrence of Cholera in Municipalities and Barrios," was completed August 1, 1903, and is ready for publication.

RECOMMENDATIONS MADE TO THE BOARD OF HEALTH DURING THE YEAR, WHICH HAVE NOT MATERIALIZED.

- (a) The installation of a sewerage system in Manila, February and May, 1903.
- (b) The damming of the Mariquina River above the town of Montalbon, reserving the watershed and piping the water direct to Manila, thus avoiding the constant danger of contamination of the water supply, and removing the expense of maintaining a pumping station, at the Santolon intake, February and May, 1903.
- (c) The walling of the esteros in Manila, and the installation of tide gates at their entrance in river and bay, or connect such esteros as can be with the Pasig River, above Manila, by canals, the object being the flushing and cleansing of the esteros, October 2, 1902.
- (d) The filling of lowlands in Manila and preventing overflow by the use of dikes, February, 1903.
- (e) The building of health stations in the permanent health districts in Manila, now occupying rented buildings, January, 1903.
- (f) The enforcement of birth and marriage reports in Manila, February, 1903.
- (g) The bringing to Manila, for one month, for duty and instruction at health stations and hospitals, all native presidents of provincial boards of health, May 8, 1903.
- (h) The division of the Philippine Islands into seven permanent provincial health districts, and the placing in charge of each district an experienced and trained health official as a representative of the board of health, February, 1903.
- (i) The opening of additional parks in Manila, and the planting of trees on an extensive scale, March 6, 1903.
- (j) The filling in or draining the moats surrounding the walled city in Manila, and directing the sewage now emptying into these moats into the bay, January 15, 1903.

Respectfully submitted.

T. R. MARSHALL,
Chief Health Inspector.

The COMMISSIONER OF PUBLIC HEALTH.

REPORT OF THE SANITARY ENGINEER FOR THE PHILIPPINE ISLANDS.

MANILA, P. I., *September 1, 1903.*

SIR: I have the honor to report, in compliance with instructions of August 15 from the commissioner of public health, that during the period September 1, 1902, to September 1, 1903, the following work was done by the division of sanitary engineering:

The organization of the repair department was improved and systemized in a manner to guard against conflicting orders being issued.

Detailed general instructions were given to all the chief sanitary inspectors as to what was essential for sanitation and as to the best methods of altering or repairing improper constructions. Frequent trips were made to the different districts, and each chief sanitary inspector was accompanied to the more difficult problems that he had met, and he was instructed as to what were the proper orders for the case, and the reasons for each order were fully explained to him.

The overseers of the pail system were experienced men who were promoted to those positions because of their superior knowledge of repair work. These men, Will Doud, Joshua Colvin, and Gus Rochel, were employed under B. H. Burrell, formerly superintendent of the pail system, in regulating the privy arrangements of houses in the districts of San Nicolas, Tondo, Trozo, Binondo, Santa Cruz, and part of Quiapo. They deserve great credit for the skill and tact with which they performed a difficult duty.

When unable to attend to matters coming from the less experienced chief sanitary inspectors, I made frequent use of the services of these three overseers in examining the correctness of the orders given.

In addition to the repairs, this office had general supervision of the pail system, and took charge of such technical matters as came from time to time to the attention of the board of health.

In accordance with orders issued November 4, 1902, the chief sanitary inspector of each district examined all the houses in his district and submitted a list of such as were considered unfit for habitation and were not worth repairing. The following

is the summary of the lists giving the districts, the number of houses recommended condemned, and the number of people living in these houses at the time of the inspection:

District.	Houses.	People.
San Miguel	193	1, 445
Santa Cruz	94	752
Tondo	69	438
San Nicolas	220	1, 620
Sampaloc	39	147
Binondo	68	507
Pandacan	164	624
Malate	267	1, 258
Ermita	487	2, 654
Santa Ana	17	93
Paco	584	3, 849
Intramuros	46	868
Total	2, 248	14, 255
Quiapo	692	5, 104

^a September 3, 1903.

I left Manila in December, and the list from Quiapo, which was delayed, never reached me.

The figures appear large, but in reality represent only a fraction of the improperly housed population—the worst fraction.

It is safe to say that 30 per cent of the population is living under very unsanitary conditions, and are crowded together to an objectionable extent. The chief difficulty that this division has found in the repair work has been the inadequateness of the housing facilities in the city, making it unjustifiable to close up or tear down any great number of houses, particularly of such as are occupied by the poorer classes.

For the upper and middle classes conditions have improved somewhat in the last year, but for the lower classes it has become worse because of the Santa Cruz fire.

The old dilapidated houses are the most crowded of any because of the cheaper rents. To condemn one of these houses drives the poor people to seek shelter in places almost equally bad and already overcrowded, and this office has considered it best to use condemnation only as the last resort.

In a communication in December, 1901, attention was called to this matter, and many times since. It was suggested that the government buy some land (several city blocks) and on this erect, in accordance with plans submitted, sanitary tenements sufficient to house 15,000 or 20,000 people.

The board of health approved of this suggestion, and the plans were submitted to the insular architect, who altered and improved the design.

The matter was now taken up by the city authorities, who stated that it was their intention to put up some tenements for the poorer classes. The tenements erected are sufficient to shelter about 60 people, I believe.

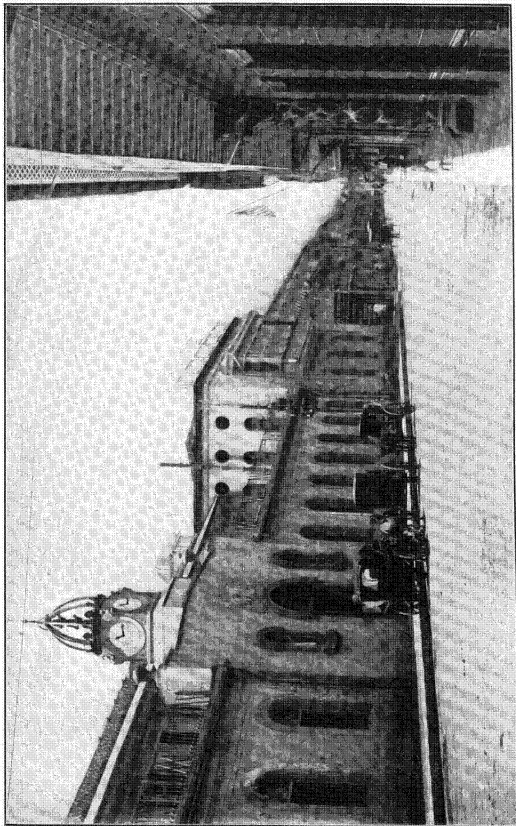
When temporary repairs are ordered on ruined houses the owners have just claim to object to tearing them down a little later, and yet this is the only action that should be taken.

This division hopes to present this matter to the Commission with complete estimates of the cost of a model tenement-house district for the Tropics and to request its action to relieve the present situation.

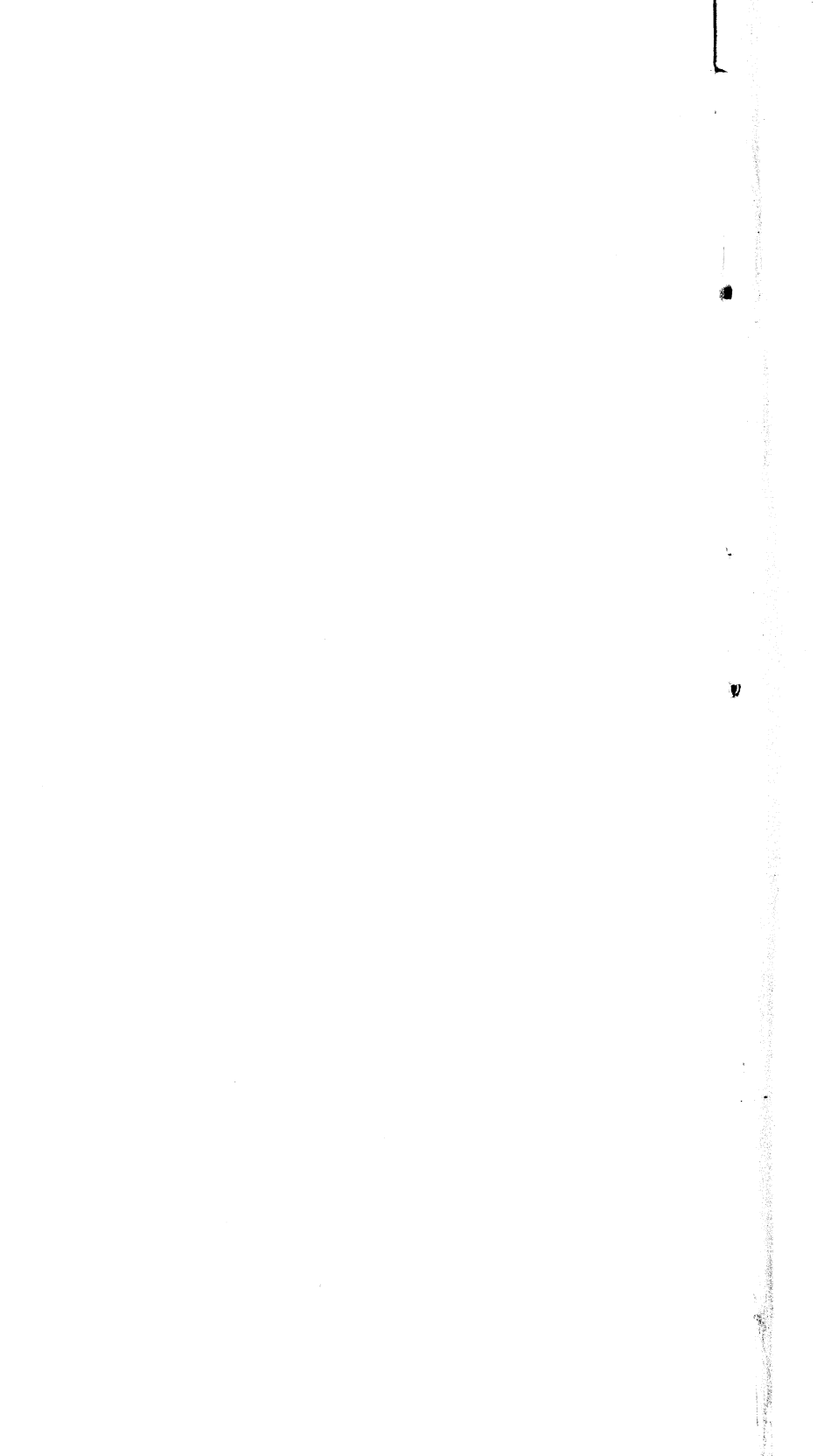
By order of the secretary of the interior, I went to Puerto Galera, island of Mindoro, in November, 1902, to examine as to the practicability of, and to estimate the cost of obtaining a water supply for the town, and for such boats as might desire it. To obtain a supply proved feasible, but the property owners of the place desired such exorbitant prices for land on which to place the government buildings that the plan has been dropped.

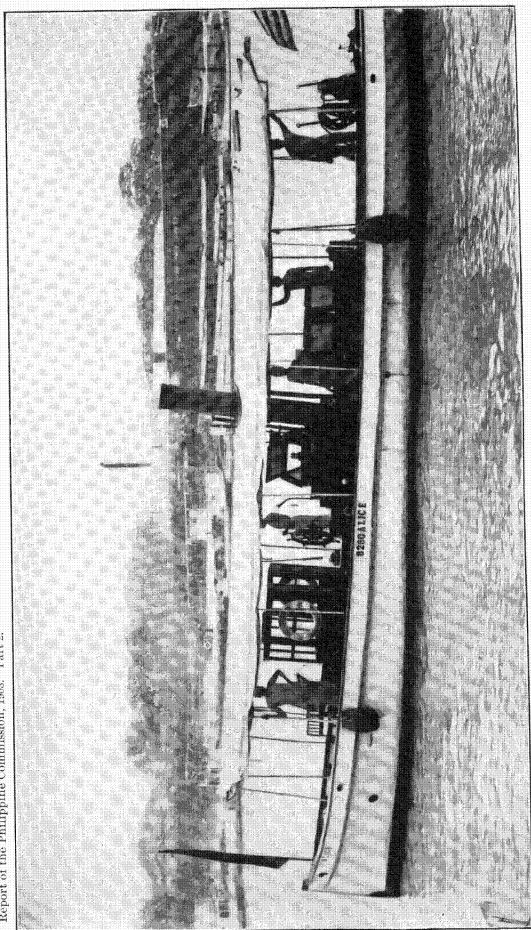
In December I was sent to the island of Culion to construct a colony for lepers. This has been fully dealt with in another report, and I will therefore mention it here no further than to say that since December it has received most of my attention. Plans and specifications are now being drawn up by this office, as it is intended to let the work by contract.

In March the repair work of the board of health was once more started under the direction of Mr. Jadin, who was later appointed to the position of sanitary engineer for the city of Manila. Much good work has been accomplished since he entered on

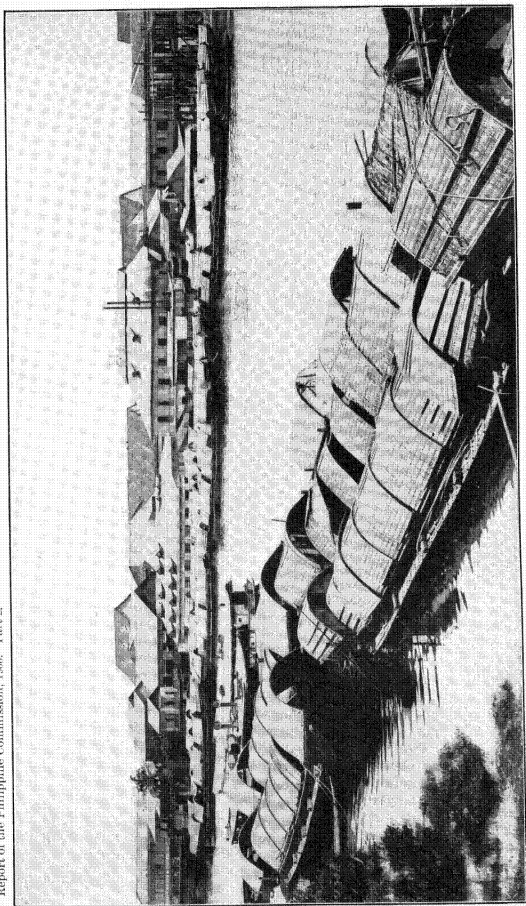


ONE OF THE BETTER STREETS IN WALLED CITY.

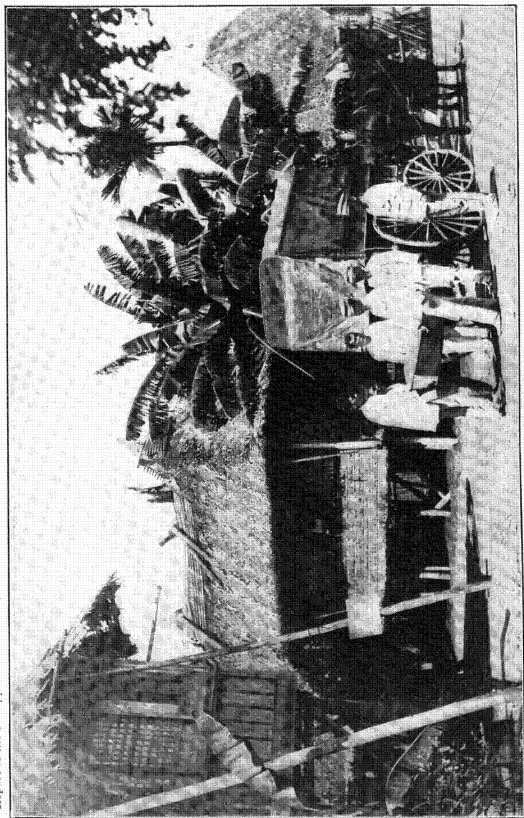




BOARD OF HEALTH LAUNCH.



INHABITED CASCOS LYING IN THE PASIG RIVER.



AMBULANCE SERVICE, BOARD OF HEALTH.

his duties, and a very important branch has been taken charge of—supervision of the sanitary arrangements of new constructions.

This office had frequently had occasion to call attention to the lack of control which the board of health exercised over new constructions, and this may be considered an important advance step toward improving the sanitary condition of the city.

The cattle quarantine station is at present the matter most pressing for attention. This division is now staking out the lines for fences of the property rented, and for the cattle pens at the station. It is intended by this office to submit to the Commission a plan for the complete reorganization of this division, and to ask for the necessary funds in the next semiannual appropriation to support the force and to supply the equipment.

From my observation and from reliable reports, it appears that all the cities and towns in the islands are in bad sanitary condition.

Manila, as the capital and largest city, is the most important problem. It has many difficult features, and by any possible method it will be a very expensive matter to bring it up to the standard of American cities, or even approximating that standard.

A complete and very careful detailed study will, in the end, prove a distinct saving of money and time.

At present Manila and some insular government work occupies the entire attention of this division, to the exclusion of all other places in the islands. This should not be, and it is hoped to remedy the matter by the proposed measures.

Act 157, organizing the board of health and specifying the duties of the sanitary engineer, limits his scope to such problems outside of Manila as may be submitted to him. The sanitary engineer should not be required to wait to be asked, but should be charged with the duty of improving the sanitary condition of all cities and towns in the Philippine Islands.

It should be his duty to examine these places and to recommend such improvements as he may consider feasible, taking into account the present income of the town, the population, and the future possibilities.

It should be made the duty of municipalities to forward to this office copies of their sanitary ordinances, and it should be the duty of the sanitary engineer to call the attention of municipal boards to anything in the ordinances that does not conform to good practice.

In important matters he should have recourse to the Commission or to the law to enforce his recommendations on the municipalities and on the individual. This support will be needed, as sanitary truths of common knowledge in the United States are unknown here, and their importance might not be appreciated by all municipal boards. How wide this power should be and how it shall be exercised is a matter for careful consideration.

The aim of this division of the board of health should be to so improve the city and the islands as to reduce to a minimum the other duties of the board of health. To do this most rapidly and readily must be a matter of education, and it is part of the intended programme to get out printed circulars from time to time, giving brief and clear statements as to what should be considered insanitary, explaining in what respects such conditions are objectionable and how to best remedy the faults. The circulars should be sent to all municipal boards for their information and guidance in enacting ordinances, where they should be kept on file for reference. A well-informed public opinion would of itself do away with many of the faults that are now so prominent.

In this report I do not care to do more than call attention to this matter, leaving the details to the time when I shall submit a special report to the Commission.

This division is well aware that the receipts of the government are not sufficient to satisfy all the needs that are calling for relief, but healthful surroundings and conditions have such a direct bearing on the prosperity and welfare of a country that sanitation may properly receive early consideration.

Deaths, loss of and interference with trade, money necessarily spent in suppressing epidemics, have cost to these islands in the last two years sufficient to go far toward placing Manila, at least, in fair sanitary condition.

The matter of permanent sanitary arrangements requires, for a thorough grasp and a proper solution, more detailed knowledge than is at hand. To obtain this information the reorganization of this division is necessary.

Very respectfully,

H. D. Osgood,
Sanitary Engineer for the Philippine Islands.

The COMMISSIONER OF PUBLIC HEALTH, Manila,

REPORT ON CONSTRUCTION OF THE CULION LEPER COLONY, BY THE SANITARY ENGINEER IN CHARGE.

DEPARTMENT OF THE INTERIOR,
BUREAU OF PUBLIC HEALTH FOR PHILIPPINES,
Manila, September 1, 1903.

SIR: In compliance with your request of July 6 for a report covering the operations at Culion Island since September 1, 1902, I have the honor to submit the following:

On or about September 24, 1902, I was verbally ordered to make an estimate of the amount of money which it would be advisable to obtain for the quarter ending December 31, 1902, to be used in building a leper colony at Culion. A previous estimate had been submitted by me in March, 1902, but was not accepted by the commissioner of public health, as it was considered excessive. I carefully revised my work, but having no additional knowledge, arrived at the same result, and sent in the same estimate on September 26. In November orders were given me to go to Culion prepared to start the work. From one cause and another the party did not get away until December 10, 1902. This extra time enabled me to obtain the more essential supplies. Under the guidance of Mr. Worcester, secretary of the interior, a visit was made to the selected site of the leper colony, where he gave me final instructions as to what he desired.

The estimate was for 100 dwelling houses, but he stated that 1,000 would be necessary and that I was to plan for that number. The sites of the principal buildings were selected and the general street and lot plan decided on.

On December 18 the construction party was landed on a point of land at Halsey Harbor, with 6 or 8 laborers, natives of Culion. These all left within three days. It was an unsuitable situation for a camp, and we suffered great inconveniences.

On January 13, 1903, 59 laborers and 2 foremen arrived from Cuyo. Up to this time practically nothing had been done. We had no boats and could not get anywhere through the brush. One ship's boat was sent in January and in the same month the natives, under the supervision of Mr. Louis J. De Puy, the general foreman, constructed several flatboats. A fish corral was at once built to obtain a supply of fresh fish for the camp. A wharf was started and was extended 210 feet to deep water. It was then attempted to saw out planks for a flooring for the wharf, but this task was found entirely beyond the skill of the natives, and it was finally abandoned as hopeless. At the land end of the wharf a space was cleared and graded and a warehouse built. Up to this point the native labor had given unexpected satisfaction, as the work was all within a small area and the entire force could be supervised by the Americans. It at last became necessary with an increased force to divide it over different parts of the work. One force was kept at the first camp, another was sent to make nipa, and a third was sent to cut out for the intended road. Under the native foremen the laborers proved almost valueless and, except when an American was present inspecting, almost no work was done. The work was laid out by piecework, fines were imposed, men caught loafing were discharged, but very little improvement was made, and a great deal of discontent was caused. These natives, either foremen or laborers, never gave any information about each other, and in consequence a great many times good men must have been punished with the guilty. The foremen served for nothing more than interpreters and never used their intelligence and energy except in rascally schemes to use the laborers for their own personal profit. Slowly these things were brought home to the guilty parties and they were discharged, although they were the only natives in the force with any ability. The more energetic laborers were promoted to low grade foremen, but in all but one case it spoiled the good laborer and made a worthless capitas.

During the month of March the work near the first camp was practically finished and the force was moved up to the intended site of the leper colony, and the collection of materials and the construction of one house was begun. Our real troubles began at this point. The men detailed to obtain supplies were necessarily scattered through the woods in small parties under the charge of native subforemen, and once out of sight in the dense underbrush it was almost impossible to keep track of them and they would do no work. I took small gangs out on the different classes of work and found out what it was just to expect, and the work was laid out by piecework. This caused constant trouble in the force, the reduction of subforemen to laborers and the appointment of other foremen, the docking of time from gangs, and the discharging of such men as were caught in the act of loafing.

In accordance with promises made them when they came, over 100 men were allowed to return to Cuyo on March 19, and from that time on it was impossible to fill the force out to any great extent. The men were discontented for several reasons.

The regular ration should be increased, and I recommend that the constabulary ration be allowed.

The Filipinos are accustomed to having their women with them, and they soon get lonesome and discontented without them. Provision should be made to allow them to bring their families with them. They are not accustomed to having any money, or what little they do have they want to spend at once. With a very little money they do not want to work.

The roadway cut out from the boat landing to the camp is $4\frac{1}{2}$ miles long and can be made most satisfactory indeed, as the grades will be very small. However, there will be numerous bridges and culverts, and at the boat landing end extensive and costly work must be done. There will be seven bridges exceeding 60 feet in length, but in some cases at least it will be perfectly practical to break the span by a center pier. There will be four smaller bridges and an uncertain but great number of culverts. For the convenience of the colony several other large bridges should be built near the site of the colony. Except some iron and cement, sufficient and satisfactory materials can be found close at hand for the constructions. Sufficient road ballast can be obtained readily and cheaply although the rock is not of very suitable character. The cost per mile of macadam road should be below the average; the cost of maintenance should be above.

One house has been constructed with the help of the common laborers. It cost considerably above the estimated figure, was done very slowly, and was not very satisfactorily finished. Besides this an excessive amount of supervision was needed. Skilled carpenters should be sent to do this work.

The original estimate was for 100 dwellings, while present instructions are to build 1,000. I believe enough timber can be obtained for this number, though naturally it must be obtained in part from greater distances, but the supply of nipa on the island will prove inadequate.

A heavy storm occurred in June and badly racked the one house constructed. This house was more strongly braced than the ordinary native house, but was not braced perfectly in accordance with the theory of bracing. At every point where theory had not been put in practice the house showed weakness. Pins 1 inch in diameter made of hard native wood were sheared off clean and sharp by the pressure of the wind. Posts planted 4 feet or more in the ground were forced out of plumb, and during heavy gusts that occurred the rafters of the roof would deflect at centers from 3 inches to 6 inches and the entire building would warp. Orders had been given to place the floors of the buildings 7 feet above the ground, but in my absence this building was started in accordance with the plans and the floor was placed but 4 feet above the surface. It is possible that with 3 additional feet of leverage the wind might have done more damage.

These buildings should not be placed at any greater height than is essential for health for the reason stated above and for economy in construction. Native methods of bracing should not be tolerated, but all the buildings hereafter constructed should be braced in the most approved manner, and skilled labor, at whatever cost, should be employed. In addition a sufficient number of Americans should be employed to keep a close watch on the laboring force sent out to collect materials.

The distance from the colony site to water transportation on the north shore is 2 miles less than that of the route at present selected. A road to the northern bay is perfectly practical, but lies through rougher country, and the first cost of it would probably not differ very much from that of the longer road. Maintenance would be less and length of haul reduced one-half. The estero or river at which the road would end is and can be made much preferable to that on the south.

The visible surface-water supply at the colony site is inadequate for the population that it is estimated must be supported, even using the lowest estimate ever given—5,000 lepers. One stream of crystal clear and beautiful water had a very constant surface flow of about 55,000 gallons per twenty-four hours during the entire dry season. Another stream of about 30,000 gallons per twenty-four hours is one-fourth of a mile to the west of the first mentioned. These two streams continued with a surface flow throughout the entire dry season of this year, which is reported by the natives of the island to have been of unparalleled dryness. I am further strongly of the opinion that subsurface flow would show considerable increases in the above figures.

This year it was impossible to put the belief to the test, as the insular purchasing agent was unable to supply the requisite machinery for the purpose.

A well was sunk to develop subsurface water, if possible. This was fairly satisfactory, but again the lack of proper machinery left the matter in some uncertainty. A thin water-bearing strata of sand was first passed through; vigorous bailing kept this under control until at a depth of 7 meters; a larger strata of sand was broken into, when the water poured into the well in such volume that it was useless to

attempt to control it. The level of the water rapidly rose to about 10 feet in depth, and then slowly 2 feet higher. Pools of fresh sweet water in the beds of dry streams throughout the different lateral valleys, show that there is subsurface water at many points. To collect and utilize this water from many different points would be very expensive, and unless some sufficient subsurface supply can be obtained at one point, it will be impractical to place the entire colony in this valley. The northern side of the island of Culion is much better supplied with water than is the southern.

At the town of Culion there is one large spring near the shore, which, however, showed signs of failing toward the end of the dry season; also one small spring back of the town. At some distance to the south of the town are other springs, and yet farther to the south at the hacienda of Señor Sandoval is a very fine stream of water of considerable volume even at the end of the dry season. At Baldat are streams, which had surface flow during the entire dry season, the weir measurements, however, were taken so late in the year that it is probable some at least of the streams were affected, though not to any great extent, by showers that had already occurred. The most eastern stream had a flow of 67,000 gallons per twenty-four hours; the next to the west, 5,000 gallons; the next had pools of water, but no flow; the next and most western stream—1 mile from the most eastern—flowed 30,000 gallons. In addition are several springs and every indication of subsoil water.

Some distance to the west of Baldat is a narrow valley of about 3 miles in length. Through this valley flows an excellent stream of water having at all seasons a volume of about 43,000 gallons per twenty-four hours. Still farther west is the hacienda "Onisan," owned by Señor Palanca. There are several streams of water on this property, which is very large. One of these streams was flowing 24,000 gallons at the end of the dry season, and without measurement I judged the other to be flowing a trifle more. There was another stream which could hardly be said to be flowing, but was a continuous chain of unstagnated water. The main stream was but a thread of flowing water, but Señor Palanca stated that never to his knowledge had it been so small, but that usually it flowed a good stream of water. Subsurface water is found at a depth below the surface of 3 meters.

To the southwest of this place is the hacienda of Señor Mayo. It is a small valley but has two very fine streams, which, however, I did not measure.

If a change of site of the leper colony is decided on, along this northern shore will be found a sufficient supply of suitable timber for the construction of all the houses desired. A launch would probably prove very useful, and as the waters are practically landlocked, it would not need to be a large one.

The land transportation problem would be much simplified by such a change, and the separation of the sexes could be much more effectively done by building at separated points where water could be obtained.

The present site is beautifully located, having fine, natural drainage, beautiful water, large stretches of open country, and almost always a refreshing breeze; but in spite of all these facts, the reputation of the place as being unhealthful was fully sustained as the rainy season approached. Almost the entire force, both office and laboring, was taken sick, and the same was true of the guards and prisoners sent down from Bilibid. So general was the sickness that it must have been caused by the water supply, and yet this could not possibly have been polluted from human sources. The water supply should be passed through a sand filter, and the same is probably true of most natural supplies in the Tropics. Malarial fever was the most prevalent disease, but there were some cases of beriberi and a few cases of severe cramps, which left the patients very weak and with small power of recuperation. There were some mosquitoes, but not many.

It is not impossible, but it appears to be impracticable, to obtain one water supply sufficient for all the persons to be sent to the island.

I therefore recommend that the colony be built in settlements and that the number of inhabitants assigned to each settlement be based on the readily obtainable water supply. While not desirable in all respects, this arrangement has many good features to recommend it.

The disbursements to June 30, 1903, from the appropriation for the leper colony, Culion, act 490, have been about \$7,000, United States currency. An exact statement can not be made, as all June accounts have not been received, nor a complete statement from the insular purchasing agent.

The distribution has been as follows:

	U. S. currency.
Salaries.....	\$1, 658
Wages.....	1, 654
Supplies, equipment, and miscellaneous.....	3, 688

The high proportion of salaries to wages is due to the fact that the office force was kept of necessity while labor could not be obtained.

Particular attention is called to wages in connection with work accomplished. Lack of results was due to lack of labor. Much was accomplished judged from the basis of wages paid.

Very respectfully,

H. G. OSGOOD,
Sanitary Engineer of the Philippine Islands.

The COMMISSIONER OF PUBLIC HEALTH,
Manila, P. I.

**REPORT OF THE SANITARY ENGINEER OF THE CITY OF MANILA FROM
SEPTEMBER 30, 1902, TO AUGUST 31, 1903.**

OFFICE OF THE SANITARY ENGINEER,
Manila, P. I., September, 1903.

**REPORT OF WORK OF THE SANITARY DIVISION FOR THE FISCAL YEAR FROM SEPTEMBER
30, 1902, TO AUGUST 31, 1903.**

In compliance with your request, I have the honor to report on the work of the division of the sanitary engineer for the city of Manila from September 30, 1902, to August 31, 1903.

Before entering into the details of the work of this division, I wish to call your attention to the fact that the sanitary division of the board of health for the city of Manila was only created in February, 1903, by special authorization of the civil commission, act 690, which went into effect in March, 1903.

The previous sanitary work was under the supervision of the sanitary engineer of the board of health, and in this report I am obliged to give data of the work done between September, 1902, and January 31, 1903, taken from the records I found in the office when I took charge of the work. Of the 2,362 orders issued only 1,720 were complied with.

When I took charge of the work in February I found the work poorly organized; by this I mean no reflection on the heads of any of the departments of the board of health. At that time it was necessary for the sanitary engineer to direct his attention to the construction of the Culion leper colony; consequently the sanitary work of the city of Manila was necessarily done by the heads of other departments, who, not being familiar with the requirements of the work, and through the pressure of their regular duties, were unable to give it adequate attention.

After a careful examination of the records of the various health districts of Manila, the necessity of a sanitary engineering division of the board of health was very evident, for many orders issued by the district medical inspector or chief sanitary inspector did not conform to the municipal ordinance of the city then in force. At the present time the authority of the board of health, under act 152, is in a way very broad, but the condition of the city, the means of a large proportion of the population, and the adequacy of the resources at hand had to be taken into consideration.

As a result of my experience of sanitary work in a tropical climate, I would respectfully suggest that the city of Manila, as now, be divided into a certain number of health districts with the following organization: The medical inspector to have charge of all work that is in line with his profession, the chief sanitary inspector to be directly under the sanitary engineer, to whom he will make his report as to what sanitary improvements are needed after the medical inspector has reported a place as being a menace to public health. Without some such system our work will be of no avail.

The sanitary department of Habana was organized on this plan, and I hope at no distant day to see the same system in operation in Manila. In short, I hold that the representative of each profession should have charge of the work for which his special training fits him.

The system generally adopted in the city by the Spanish Government was that known by the name of "pozo mauras."

Pozo mauras, as understood by engineers and architects here, is only an ordinary vault provided with a siphon pipe in its upper part, discharging directly into the street gutter. It is a well-known fact that the discharge was by no means pure liquid, but a semiliquid, which is more dangerous to public health than the ordinary

discharge of solid matter. The pozo maurus system was unventilated, and no oxidation could take place, and in view of the fact that semiliquid discharge is so dangerous to public health, the commissioner of public health ordered this department to devise a system which would give at least temporary relief, until a modern sewerage system is adopted.

I recommended the same system that I introduced into Habana, when executive officer and sanitary engineer for the sanitary department under Col. W. C. Gorgas. This was adopted in experimental cases, and results were very satisfactory.

The system consists of an ordinary vault connected by means of a siphon to another vault, which is provided with a filter composed of sand, charcoal, and gravel; the discharge pipe is provided with a strainer to protect the filter, and the discharge is into a sewer, an estero, or the river Pasig.

In case none of these are at hand a third receiving vault is built, and all the liquid is received into it, to be pumped out by scavengers. All the vaults are made watertight in construction, which was not the case formerly; thus the contamination of the subsoil is thereby avoided.

The reckless methods of architects and builders in vogue in Manila necessitated this regulation, that every building permit be passed upon by the board of health before its final approval.

In the preparation of these plans attention is given to ventilation and location of closets, which in Spanish times were always located adjoining the kitchen.

Plans illustrating the disposal of sewage, plumbing, etc., were prepared for the benefit of architects and contractors, who had no conception of the principles of modern sanitation.

Every detail is explained to them and, although it has been a hard task for this department to have them do away with their old system of three hundred years, slowly but surely this department is succeeding in this line; no buildings are erected now until all the sewage and plumbing work has been approved.

This branch of the department was inaugurated in March, 1903, over two hundred permits are on file in this office and regular inspections are made of the work as it progresses, in many cases they try to avoid our plan but when compelled to do so a careful vigilance is maintained. Two inspectors are detailed to inspect the work and daily reports are made by each inspector.

The following plumbing ordinance was drawn up by Mr. Ingalls, city engineer, and myself; they are not yet in force, but it is urgently needed in this city where unskilled laborers and contractors do as they please.

These regulations will protect the trade, the owner, and the public health.

AN ORDINANCE REGULATING PLUMBING, THE ISSUANCE OF PLUMBERS' LICENSES, HOUSE DRAINAGE, AND THE MAKING OF OPENINGS IN THE STREET.

Be it ordained by the municipal board of the city of Manila that:

SECTION 1. The inspector of plumbing is hereby charged with the supervision of plumbing, drain laying, drainage and ventilation of sewers, and with the enforcement of these regulations. He shall at all times be under the direction of the commissioner of public health.

SEC. 2. The inspector of plumbing shall, before entering upon his duties, take or subscribe an oath or affirmation that he will faithfully perform the duties of his office, and execute a bond in the sum of twenty-five hundred (\$2500) dollars, United States currency, payable to the said city of Manila, for the use and benefit of such persons as may be damaged by his unlawful acts or negligence, with sureties to be approved by the municipal board of the city of Manila, and conditioned for the faithful performance of the duties of his office.

SEC. 3. He shall inspect, or cause to be inspected by his assistant, the plumbing, drainage, and ventilation of sewers of all houses in course of erection in said city, and require that the same conform to these regulations.

He shall, at reasonable hours, upon his own motion, or on application of an owner or occupant, or upon the complaint, under oath, of any reputable citizen, inspect or cause to be inspected the plumbing, drainage, and ventilation of sewers of any house or premises in said city; when any premises shall have been so inspected and defect in the material or plumbing work shall have been found, written notice of such defects shall be served upon the owner or agent of the premises. The owner or agent shall, within ten days after such notice, make the repairs or changes directed therein.

SEC. 4. The inspector of plumbing shall promptly examine all plans and specifications for proposed plumbing work and house drainage which may be filed in his office, and shall approve the same if in conformity with these regulations.

SEC. 5. No person other than a licensed plumber, or an employee of a licensed master plumber, shall engage in the work of plumbing in the city of Manila.

SEC. 6. No plumbers' license shall be issued to any person who is not of good moral character and at least twenty-one years of age; every application for a plumber's license shall be accompanied by a certificate of good moral character, signed by at least three reputable citizens of the city of Manila.

SEC. 7. Every licensed plumber shall register his name in a book to be kept for that purpose by the health department, giving full name, residence, and place of business, and in case of removal from one place to another in the city shall make change in said register accordingly, and every such person shall display at his place of business, in a conspicuous place, a sign with full registered name and the words: "Registered Plumber, Fontenero Registrado," in letters not less than three inches in size. No person shall display a sign stating or implying that he is a licensed plumber unless such is the fact.

SEC. 8. No person shall employ any other than a licensed plumber to do plumbing in or about any premises in said city.

SEC. 9. When any licensed plumber shall neglect or refuse to comply with these regulations or with the conditions of his permit, after written notice, his license may be suspended or revoked by the municipal board, and thereafter no plumbing permits shall be issued to him until he shall have conformed in all respects with the requirements of these regulations and of his permit.

SEC. 10. Bad faith or unreasonable delay in the performance of the plumbing work shall be deemed a sufficient reason for the suspension of a plumber's license, and every plumber shall be held responsible for the violation of these regulations by mechanics, laborers, and helpers employed by him.

SEC. 11. Before any portion of the water supply or drainage system of any building, premises, or establishment shall be laid or constructed, there shall be filed with the inspector of plumbing, by the owner, architect, or builder, plans and specifications therefor, showing the said system entire (including trap, supply, waste, and ventilating pipes), from its connection with the public sewer and water main to its terminus inside the building line, and giving the name of plumber who is to perform the work. No work shall be performed until said plans and specifications have been approved in writing by the inspector of plumbing. No plumbing or drainage work shall be done upon any building, except pursuant to the approved plans and specifications therefor, and no alterations shall be made in said plans and specifications without the written approval of the inspector of plumbing. These plans and specifications shall be kept on file in the office of the inspector of plumbing.

SEC. 12. No permit shall be given for the erection of any building until said plumbing plans and specifications have been presented and approved.

SEC. 13. When any extensions or alterations of fixtures or pipes shall be made in building or premises where the plumbing system has already been constructed, the plumber making such alterations or extensions shall notify the inspector of plumbing of same, so that they may be examined.

SEC. 14. No person shall make any cut, trench, or excavation in any highway, reservation, or public place in the city of Manila, or disturb or remove any public work or materials therein, without a permit so to do from the city engineer, which said permit shall be kept at the place of excavation while work is being done, and exhibited whenever called for by the inspectors, police, or other persons having authority to examine the same.

SEC. 15. No authorized underground construction shall be injured or disturbed in making such excavation, without permission in writing from the city engineer. All trenches for the laying of pipes shall be filled on the same day that they are opened, and the city of Manila shall be protected and saved harmless from any loss or damage to any person, growing out of the issuing of said permit to excavate.

SEC. 16. No house or premises shall be connected with water or sewer, without a permit first obtained from the city engineer. The conditions of this permit shall be strictly complied with, and in case of connection with the sewer, the work shall be done by the plumber in whose name the permit is given. This regulation shall apply to all sewers whether on private property or in public street or alleys.

SEC. 17. Applications for permits to excavate in any public street shall be made to the permit clerk in the office of the city engineer. Blank forms of application will be furnished at said office. One (\$1.00) dollar, United States currency, shall be paid to such employee of the city of Manila as shall be authorized by the municipal board to receive the same, as a permit fee for each excavation in any street or public place for the laying of water, sewer, or other pipes, or for any other purpose, and the receipt of this fee shall be entered upon each application. The fee shall in all cases be paid before the granting of the permit.

SEC. 18. Plumbers and others removing valuable material from the street, such as granite blocks, shall be held responsible for the same until it shall be replaced by the

city, and any such material lost or injured shall be charged against the person obtaining the permit.

Sec. 19. All repairs to pavements over plumbers' cuts, shall be made by the city of Manila, and the actual cost thereof must be paid by the plumber who is responsible for the same, within ten days after the rendering of the account; failure on the part of the plumber to comply with these regulations shall justify the suspension of his license until said account shall have been paid.

Sec. 20. Every application to connect a building, lot, premises, or establishment with a water main or service pipe, public or private sewer, conduit or subway, or other underground structure, or to repair a house, sewer, or service pipe, for water or any other underground structure, shall state the exact location and number of building or premises.

Sec. 21. No water service pipe for any building, lot, premises, or establishment, shall be laid over or through any other building, lot, premises, or establishment. No person shall connect or cause to be connected any building, lot, premises, or establishment with a water-service pipe belonging to or supplying any other building, lot, premises, or establishment. Every water service pipe or house sewer shall be run from the public street directly into the building, lot, premises, or establishment to be served; provided, that where, from the situation of the premises it shall be impossible to comply with the provisions of this section, permission in writing may be given by the plumbing inspector to deviate therefrom to such extent as he may deem necessary.

In violation of this section the supply of water of all premises affected may be cut off and not again turned on until the service pipe shall have been laid as required herein.

Sec. 22. No water main shall be tapped under any circumstances, except by regular tapper of the water department.

Sec. 23. No person shall lay or cause to be laid any permanent underground water-service pipe for the introduction of water into any building, lot, premises, or establishment of any other material than drawn lead pipe of standard weight hereinafter specified, galvanized iron, or cast-iron pipe coated as prescribed for water mains. Cast-iron pipes will be tested to the satisfaction of the superintendent of water supply before being covered. The use of cast-iron service pipes less than two (2) inches in diameter will not be permitted.

Sec. 24. Lead pipe used for water service shall be of the class known as "strong," and of not less than the following weights per linear foot:

Inside diameter of pipe.	Weight per foot.
	<i>Lbs. Ozs.</i>
$\frac{1}{2}$ inch	2 0
$\frac{3}{4}$ inch	2 8
1 inch	3 0
1 inch	4 0
$1\frac{1}{4}$ inches	4 12
$1\frac{1}{2}$ inches	6 4
$1\frac{3}{4}$ inches	6 12
2 inches	7 0

No plain black uncoated steel or iron pipe shall be used in the water supply.

Sec. 25. There shall be placed on every service pipe without the building supplied a stopcock for the purpose of cutting off the water supply.

Sec. 26. No person shall lay or cause to be laid a water-service pipe in a trench excavated for a house sewer unless the same be located at least fifteen inches from the house sewer measured horizontally.

Sec. 27. Every service pipe laid on private property shall be subject to inspection by the inspector of plumbing. Inspectors shall require all materials and workmanship to be established by law and by these regulations. Any service pipe laid and covered without inspection and approval shall be promptly uncovered by the plumber holding the permit for doing the work.

Sec. 28. All house sewers shall be laid entirely within the limits of the lot proposed to be drained, provided that where the situation of the premises shall render it impossible to comply with this requirement, permission in writing may be given by the inspector of plumbing to deviate therefrom to such an extent as he may deem necessary, and no vitrified pipe can be laid within five feet of the wall of any building.

SEC. 29. House sewers and connections thereof with the public sewer, and all fittings and other material used for such connections shall be inspected by the inspector of plumbing or his assistants.

SEC. 30. Each house sewer shall be laid true to line and grade, each section of pipe being properly bedded. The joints of cast-iron pipe shall be leaded and calked; those of terra-cotta pipe shall be laid with mortar composed of one part hydraulic cement and two parts of clean river sand, upon a foundation of hydraulic cement concrete, not less than eight centimeters in thickness, composed of one part hydraulic cement and two parts of clean river sand and four parts of either small broken stones, broken brick, or clean river gravel. No house sewer shall be laid upon a grade less than one to fifty. Whenever practicable, the uniform grade shall be preserved throughout the entire length of the horizontal run of the house sewer.

SEC. 31. No cement, wax, grease, paraffine, plaster, sal ammoniac, or other improper substance, shall be used about any joint of the plumbing system, and the presence of any such foreign substance about a joint shall be a sufficient cause for condemning such joint. Any split cast-iron fittings or hub may be condemned and marked by the inspector of plumbing or his assistant; in such case such fitting or pipe shall not be again used.

SEC. 32. No person shall, without special permission from the commissioner of public health, connect or cause to be connected the draining system of any building, lot, premises, or establishment, otherwise than with that portion of the public sewer system intended for use, as shown by the record in the office of the city engineer, nor shall any connection be made below the springing line of the sewer. Every connection shall be made flush with the walls of the sewer, and all excess material removed from the sides and bottom.

SEC. 33. Two or more dwellings built upon the same lot shall each have a separate house sewer, and neither dwelling shall drain under or through the premises or dwelling of the other, provided that where, from the situation of the premises, it shall be impossible to comply with the provisions of this section, permission, in writing, may be given by the plumbing inspector to deviate therefrom to such an extent as he may deem necessary.

SEC. 34. Every soil, drain, waste, and vent pipe shall be of iron, lead, or brass, with screwed, leaded, and calked or wiped joints, and shall be so located as to be accessible for inspection. Pipes of this kind shall be kept above ground, if practicable. When wrought-iron vent pipes are used they shall be of galvanized iron provided with galvanized fittings. No cast-iron vent pipes shall be of less diameter than three inches.

SEC. 35. The size of soil and waste pipes shall not be less than that set forth in the following tables. Horizontal lines shall be increased as fixtures are added, but verticals throughout their entire length shall be of the diameter given for the total number of fixtures which discharge through them.

	Number of water-closets.
Horizontal runs:	
4 inches	1 to 6.
5 inches	7 to 12.
6 inches	13 to 20.
Vertical runs:	
3 inches	(See sec. 48.)
4 inches	1 to 12.
5 inches	13 to 25.

Each vertical soil line into which the water-closets of two or more floors discharge shall be extended full size through and above the roof or be connected full size in an approved manner into line thus extended.

SEC. 36. Every soil and waste pipe shall have a slope or incline of at least 1:50 and vent pipes not vertical shall have a continuous slope. No such line shall be run with unnecessary bends or offsets, and where changes of direction shall be unavoidable, they shall be made with bends of not more than forty-five (45) degrees, if practicable. No air line shall be laid without the best obtainable slope and so as to avoid unnecessary length of bends.

SEC. 37. When any soil, drain, or vent pipe shall be increased or reduced, a proper fitting shall be used. Tail-end pieces shall not be used for that purpose.

SEC. 38. Soil, drain, vent, and waste pipes, and traps shall, if practicable, be exposed to view for ready inspection at all times and for convenience in repairing. No such pipe shall be built into any masonry wall.

SEC. 39. When a soil pipe or house sewer shall pass under any masonry wall there shall be provided a relieving arch to prevent injury from settling of the wall, or there shall be built into the wall an iron pipe not less than two inches in diameter greater than the pipe proposed to be run.

SEC. 40. Approved fittings of iron or brass shall be used for all connections with drain, soil, and waste or vent lines shall be tapped.

SEC. 41. Every plumbing fixture shall be separately trapped by a water-sealed trap placed as close to the fixture outlet as possible, and if located within the building vented, excepting that in the case of the upper or only closet on a soil pipe, extended full size through the roof, said closet having its center within 2 feet of the center of the stack, a vent shall not be required. A single trap may be used for a two or three part wash tray or basin.

Where three or more water-closets discharge immediately into a horizontal branch and thence into a vertical soil line carried through the roof as a vent, the inspector of plumbing may, with the approval of his immediate superior, authorize the omission of the separate trap vent and the substitution therefor of an extension of the branch line not less than three (3) inches in diameter, to be reconnected to the main vent or carried through the roof independently, as he may determine.

SEC. 42. Every vent shall be taken from the crown of the fixture, except for water-closet trap. Each such trap, unless exempted by the application of section 43, shall be vented from the branch line just below the trap with a vent so connected as to prevent obstruction and above all small waste inlets. No horizontal vent line longer than 2 feet shall be allowed beneath a floor adjacent to the trap.

SEC. 43. No trap with a hand-hole cover shall be used. No lead trap less than 1½ inches shall be used, except on lavatories, where a 1¼-inch trap may be permitted. Every trap shall have a water seal of at least 1½ inches. The weight of a one and one-half lead trap shall not be less than 3 pounds per running foot, and larger sizes shall not be of less thickness.

SEC. 44. Every vent pipe shall be run separately above its fixtures in order to prevent its use as a waste.

SEC. 45. Each vent pipe shall be connected above the highest fixture into the adjacent soil pipe if distant therefrom not more than six feet. If more than this distance from the soil pipe it may be independently extended above the roof. A vent line shall be, whenever practicable, a direct extension of a soil or waste line. Main vent risers having a length of fifteen feet or more shall be connected at the foot with the main waste or soil line below the lowest vent outlet and with no greater angle of connection or of more than forty-five degrees.

SEC. 46. The size of main and branch vent pipes shall be increased as fixtures are added as follows:

Diameters, maximum length.	Number and size of traps vented.
1½ inch, 25 feet.....	1 to 2 traps, 1½ or 2.
2 inch, 50 feet.....	1 to 5 traps, 3 or 4.
2½ inch, 75 feet.....	6 to 9 traps, 3 or 4.
3 inch, 100 feet.....	10 to 15 traps, 3 or 4.
4 inch, 150 feet.....	16 to 25 traps, 3 or 4.
5 inch, 200 feet.....	26 to 40 traps, 3 or 4.

SEC. 47. No waste or drain pipe shall be of less size than the fixture trap, except that a lead trap one and one-half inches in diameter may have a waste pipe one and one-quarter inches in diameter. The inspector of plumbing may authorize the placing in a two-story dwelling of a three-inch soil and vent stack when the three-inch stack shall be run without offsets or bends, and when the connection with the water-closet shall be made by means of a recessed brass thimble and a three-inch eight-pound lead bend, suitably flanged to receive the closet.

SEC. 48. The weights of all cast-iron pipe used for drainage on horizontal runs shall not be less than—

Inside diameter.	Weight per linear foot.	Inside diameter.	Weight per linear foot.
	<i>Pounds.</i>		<i>Pounds.</i>
2 inches.....	5½	7 inches.....	27
3 inches.....	9½	8 inches.....	33½
4 inches.....	13	10 inches.....	45
5 inches.....	17	12 inches.....	54
6 inches.....	20		

SEC. 49. All cast-iron pipe used in stacks and vertical runs shall be standard and the weight not less than—

Inside diameter.	Weight per foot.	Inside diameter.	Weight per foot.
	<i>Pounds.</i>		<i>Pounds.</i>
2 inches.....	2½	7 inches.....	15
3 inches.....	4¾	8 inches.....	17½
4 inches.....	6½	10 inches.....	29
5 inches.....	8½	12 inches.....	40
6 inches.....	10½	15 inches.....	45

SEC. 50. All cast-iron pipe used shall have cast upon it, directly back of the hub of each section, the weight per linear foot and the name of the manufacturer, in characters not less than one-half inch in length.

SEC. 51. All wrought-iron soil, drain, or waste pipe used in a building shall be standard iron pipe, not less than one and one-half inches in diameter, and the weight not less than—

Diameter.	Weight per linear foot.	Diameter.	Weight per linear foot.
	<i>Pounds.</i>		<i>Pounds.</i>
1¼ inches.....	2.68	4 inches.....	10.66
2 inches.....	3.61	4½ inches.....	12.34
2½ inches.....	5.74	5 inches.....	14.50
3 inches.....	7.54	6 inches.....	18.76
3½ inches.....	9.00		

All joints in said pipe shall be screwed joints, carefully made up, and the burr formed in each pipe end, due to cutting, shall be completely removed by reaming or filing. A one and one-half inch wrought-iron waste shall be limited to the drainage of a single fixture, with no portion of the run at a less slope than forty-five (45) degrees, and all angles made with one-eighth ($\frac{1}{8}$) bends, and not to exceed twenty feet in length.

SEC. 52. All fittings used in connection with iron pipes shall correspond with them in weight and quality.

Fittings on wrought-iron soil and waste lines shall be extra-heavy cast-iron recessed and threaded galvanized drainage fittings, tapped with a slope of one-quarter inch to the foot, for horizontal runs.

SEC. 53. All changes of direction in soil and house sewer pipes shall be made by means of suitable bends, and all connections by means of Y branches and one-eighth ($\frac{1}{8}$) or one-sixteenth ($\frac{1}{16}$) bends. All connections of lead pipes with iron branches shall be made by means of recessed brass thimbles, the full size of the iron pipe, caked into the iron with lead and wiped joints. No double hub, double Y, or double T Y branches shall be used on horizontal runs, nor shall double T Y branches be used on verticals. The use of bands, saddles, and sleeves is prohibited. All pipe runs shall be made as direct as possible, and offsets in vertical soil and waste line shall not be constructed without the permission of the inspector of plumbing.

SEC. 54. No water-closet shall be placed in any sleeping room, or in any room, apartment, or vault not in direct communication with the external air or a vertical air shaft, by means of a window or air space having an area of at least four square feet for the admission of light and fresh air.

SEC. 55. Means shall be provided for thoroughly flushing all soil pipes, drain pipes, water-closets, and urinals. A copper-lined flushing tank of adequate size, provided with a flush pipe not less than one and one-quarter inches in diameter, shall be supplied for every interior water-closet, and such tank shall not be used for any other purpose. Pan, valve, plunger, or offset water-closets shall not be installed, nor shall such a closet now in use be maintained if complaint thereof shall be made by an occupant of the building in which the closet is located. When a bowl or trap of either type of closet above mentioned or of a straight or oval hopper closet within a building shall be defective, such portion shall not be replaced, but an approved closet shall be substituted for the old fixture.

A straight or oval hopper closet shall not be installed within a building except upon the approval of the inspector of plumbing. A straight-hopper closet may be condemned by the inspector of plumbing upon complaint, if in an unsanitary condi-

tion, and shall then be replaced by a short-hopper closet of approved type, if ordered by the inspector of plumbing.

Whenever a water-closet of prohibited type shall be replaced, the adjacent small fixture waste and vents shall be reconstructed, so as to bring them into conformity to these regulations, and the soil stack shall be extended above the roof level.

SEC. 56. In altering old buildings, and in introducing plumbing, outside water-closets shall be located and flushed as above, where practicable, but the inspector of plumbing may, with the approval of the commissioner of public health, authorize when necessary the use of a straight-hopper closet, located to the best advantage, and flushed by means of an approved hydrant-hopper cock.

SEC. 57. Every water-closet within a building shall have a lead or brass connection, and shall have a cast brass flange of not less than one-quarter of an inch in thickness to insure a tight joint bolted to the flange on the closet. The weight of a four-inch lead bend for a closet connection shall be not less than eight pounds per running foot.

SEC. 58. Where any water supply is not ample for thoroughly flushing water-closet, urinals, and other fixtures, a tank or cistern into which water may flow at night, or into which it may be pumped, may be provided.

SEC. 59. No waste pipe from a refrigerator or other receptacle in which provisions are stored shall be connected with any drain, soil, or other waste pipe. Such waste pipe shall be so arranged as to admit of frequent flushing and shall be as short as possible.

SEC. 60. When the plumbing in any premises shall be ready for inspection the master plumber in charge of the work shall notify the inspector of plumbing. After the work is completed it shall be reported for final inspection and test.

All soil, waste, and vent pipes for new buildings shall have the openings stopped and a test of not less than three pounds air pressure to the square inch upon a mercury gauge applied by the plumber in the presence of the inspector of plumbing or his assistant and maintained for such length of time as to satisfy the latter that the work is sound and tight. There may be substituted for testing horizontal lines or drains a water-pressure test under a head of at least five (5) feet in lieu of the air-pressure test above specified.

The final test may be made in the presence of the inspector of plumbing, or his assistant, by means of an improved peppermint test, if desired.

Repairs and extensions to any part of the drainage system shall also be reported for inspection, excepting minor repairs to lead wastes, where no portion of the waste or trap shall be removed, or resetting or replacement of fixtures whether neither waste nor vent shall be disturbed.

SEC. 61. A certificate of approval shall be issued by the inspector of plumbing upon the satisfactory completion of any plumbing work. The water shall not be turned on to a new building, or the plumbing used before the issuance of the final certificate for the plumbing thereon.

SEC. 62. Whenever a house sewer or drain shall become obstructed, or broken, or defective, so that sewage or drainage escapes therefrom into the surrounding soil or into adjacent premises, the inspector of plumbing shall condemn such sewer and order its repair or replacement.

SEC. 63. Under no circumstances whatever shall verbal permission given by any one, whether connected with the board of health or with the government of the city of Manila or not, be considered a justification for any deviation from, or violation of, these regulations.

SEC. 64. In case no inspector of plumbing shall be appointed to perform the duties provided in these regulations, the term "inspector of plumbing," which has been used throughout these regulations, shall be applicable to the sanitary engineer, who may be designated to perform said duties until the position of inspector of plumbing shall be filled.

In case the sanitary engineer shall assume the duties of this office he shall qualify in accordance with the provisions of section 2 of the proposed regulations, and do all the work called for in these regulations that would be performed by an inspector of plumbing.

SEC. 65. Any person violating any provision of this ordinance shall, upon conviction thereof, be punished by a fine not to exceed one hundred dollars, or imprisonment not to exceed six months, or both, for each offence.

SEC. 66. All ordinances, orders, and regulations, and parts thereof inconsistent herewith, are hereby repealed, and this ordinance shall take effect and be in force on and after the — day of —, 1903.

Enacted —, 1903.

Many places in Manila were found to be in a very insanitary condition, especially in the convents, monasteries, and large factories where hundreds of people are housed;

even private dwellings among the best class in Manila were in a deplorable sanitary condition, but these have all been put in a good sanitary condition, as to plumbing and sewage disposal, by the introduction of the septic tank.

As there is as yet no sanitary ordinance in force, through the strong support of the civil governor this department has accomplished more than it expected; still much remains to be done.

The support of the prosecuting attorney has been one of the main factors in the progress of this department.

Formerly cases for prosecution were left to the discretion of the medical inspector or the chief sanitary inspector. Thus much confusion resulted, owing to the ignorance of technical matters on the part of those in charge of the prosecution.

A request was made to the commissioner of public health that all sanitary orders not complied with in due time be forwarded to the sanitary engineer before being sent to the prosecuting attorney. The object of this being to protect those who were willing to fulfill the order, yet were unable on account of physical obstacles. All cases now referred to the prosecuting attorney are those where the owner has unqualifiedly refused to do the work. In cases where lack of means or other difficulty is proved to be true, time is given to the owner who shows a willingness to obey the sanitary order.

Since September, 1902, 5,074 orders have been issued; 3,549 have been complied with; 127 cases have been sent to the prosecuting attorney; \$450 gold for fines has been imposed, and one month's confinement.

The Trozo fire crippled for a time the board of health, especially in regard to the pail system, as will be detailed below.

Complaints were frequently received of the wrong disposal of sewage by the Civil Hospital—the vault was constantly overflowing. A survey was made first of the plumbing system, which, although modern, was lacking in perfection; repairs were made, but the same trouble with the vault still persisted. The three excavators of the board of health were not sufficient for the great amount of water used in the Civil Hospital. Unfortunately the Trozo fire crippled the board of health in its means of transportation. The only way to remedy this nuisance was to run a sewer to the nearest estero and to adopt the septic vault system. An order was given and this department submitted a plan and specifications for the construction of a 1,500-foot sewer and the installation of a septic vault in addition to the one then in use. An appropriation of \$3,000, United States currency, was made, and in a month's time all work was finished under the control and supervision of this department. Since then no complaints have been received, the septic tank and sewer working in good order.

It must be borne in mind that sewer construction is not easy in the city of Manila, where no pumping is furnished. The sewer having to discharge into an estero, a very little fall was available, and the consideration of freshets being essential.

In regard to the esteros of the city of Manila, the following report was made to the commissioner of public health:

The present condition of the esteros in the city of Manila is a menace to public health. For many years no effort has been made to clean or improve them, their present deplorable state being the natural consequence.

The position of these waterways makes them a valuable means of transportation. They afford, furthermore, a natural drainage system during the rainy season.

There is but one course to pursue in regard to them; instead of making them a receptacle for filth and garbage, thus forming a breeding place for mosquitos and other vermin, let them be restored to their natural condition.

It is the duty of the board of health to call the attention of the honorable civil governor to the necessity of the dredging and cleaning of these esteros. In their present state rubbish and fecal matter accumulates, covering their banks, impeding the flow of water, and submerging that part of the city which under all circumstances ought to be dry.

The idea that these esteros are washed out and cleaned during the rainy season is, from my point of view, incorrect. At the first freshet the fecal matter, garbage, and rubbish deposited on their banks are washed out over the new high-water mark, and when the tide falls this matter lies upon the ground, under houses and in yards, exposed to the rapidly decomposing action of a tropical sun.

In view of the fact that these esteros form a natural way of transit in the city of Manila, it seems but just that they be kept in such a condition that they will not only not be objectionable, but that they will be useful as a means of transportation. At present traffic is impossible in many of them at low tide. The municipal board has concluded to tear down the walls surrounding the old city; too much praise can not be given them for this decision. At the same time that they are abating a serious menace to the public health they are affording material that may be utilized to

excellent advantage in the construction of retaining walls for the esteros. The drainage of the bay will, in my opinion, give material enough to fill the moat. The sand dredged from the esteros (after a process of disinfection) can be used to fill a part of the retaining wall which will have to be built along their banks. By this means the cost of construction will be greatly reduced.

There is a tendency on the part of some to feel that too much is being done for Manila. I, for one, do not believe enough can be done in the matter of sanitation. Capital can not be attracted to these islands, prosperity can not be established, the efforts of the government can not be realized, until man may live in the capital of the islands with a reasonable guaranty of safety as regards his health.

I would call your attention to the condition of Habana, Cuba, when the American Government temporarily took possession of that island. Conditions similar to those existing in this city were there found, but I am glad to say that our efforts to overcome and abate these nuisances were successful. The Government, realizing the importance of our work, gave us full power to act; the result was that after two years' work we rid the city of Habana of yellow fever, and for over two years not a case of small-pox was reported. When the Government withdrew, on the 20th of May, 1902, for seven months not a case of yellow fever had occurred, and when Major Gorgas and myself left, in October of the same year, just one year had elapsed without a single case of yellow fever.

These facts are of sufficient importance to call attention to the necessity of immediate action as regards the esteros. Their improvement will not only benefit public health, but by affording better modes of transportation will materially assist business.

Taking into consideration all these statements, I have the honor to request that the board of health call the attention of the government to this matter, requesting the appointment of a commission to study the question, to draw up plans and specifications for the improvement of these esteros that are still serviceable, and for filling in those of no practical value.

When the old walls are torn down, the moat filled in, the esteros put in good condition, a decided step will have been taken in the betterment of the sanitary condition of the city of Manila, and this at slight cost, for the large extension of valuable ground secured through these improvements will practically cover all the expense incurred.

"The walled city," or Manila proper, presents peculiar difficulties to the sanitary engineer. The wall surrounding this portion of the city prevents the free circulation of air so necessary to comfort in a tropical climate.

The moat surrounding the wall is a continual menace to the public health. Every sewer of the walled city empties into the moat, and the stench at low tide is unbearable.

Under no modern health regulations could such conditions be permitted to continue.

The sewers of the walled city are another danger to the public health. They are rectangular in form, constructed of rough stone of porous character; the bottoms, if any, have loose joints, and the consequent filtration is especially pernicious in this tropical climate. Most of these sewers are constantly filled nearly full, the catch basin is a hole in the corner of each block without any trap, and the foul gases coming from them are a constant danger to public health.

Immediate provision is recommended for remedying this condition of affairs in the very near future.

By the Trozo fire the entire nipa district of that portion of the city was wiped out, and a committee composed of the city engineer and myself was appointed to report on the feasibility of establishing public closets; plans were drawn and it was recommended that a vault of a good size be built in the center of each lot; the dry closet system was recommended; these vaults to be cleaned every six months. The pail system is not adapted to that district, on account of the land being low and in the rainy season flooded with water, and vaults are recommended to be constructed 3 feet above the level of the surrounding land.

A space was recommended to be left in the middle of the lot with an alley leading to it. This will give more ventilation to that thickly populated district, which in time of epidemic this department had hard work to properly police on account of the character of the population.

This division also furnished plans and specifications for the drainage and sewerage system of the San Lazaro Hospital and the new cholera hospital.

Plans and specifications for the drainage of the new corral were also furnished.

The system in vogue in Manila in regard to cleaning vaults and cesspools is defective, if not dangerous. The operation of cleaning these places may be dangerous to the laborers in badly ventilated places, as nearly all such places are in Manila. Hand

removal is not adapted to cities, on account of the time consumed, the uncleanness, and the odor attending it.

The combined suction and force pump of the odorless excavator, which is inconvenient under any system, quickly wears out the pump. To this difficulty must also be added the long time required and the vile odor, hence this method has been replaced in many cities by the portable steam-pump system described as follows: A steam pump mounted on wheels; the fires are usually fed with coke, since it gives little smoke; the pumps are usually of from 2 to 3 horsepower, worked with 30 to 60 pounds pressure, and require from 110 to 150 pounds of fuel daily. It requires about two minutes to create a vacuum of one-third to one-fourth of an atmosphere in an iron cask of 660 gallons. This reduction of pressure is sufficient to draw a vault of nearly all its contents, even when they are quite thick. Five men will fill from 50 to 70 casks daily. The air that is pumped from the vault is forced through the fire and all gases burned. This apparatus is extensively used in Strasbourg, Metz, Karlstad, Munich, Habana, and other cities.

The Lenoir system is about on the same plan, and works with good results.

In the city of Manila it is strongly recommended that the vault cleaning be done only by a night-soil gang, under the direction of the board of health, adopting one of the two excavators described in this report.

The importance of a sewer system for the city of Manila is of the most urgent necessity. All the work heretofore accomplished by the board of health will be of no avail without a sewer system.

The time necessary to devise a suitable system and prepare plans and specifications is a sufficient reason for urging immediate action. Valuable time has already been lost. The question of a sewerage system for the city of Manila is one which must be met and acted upon without unnecessary delay.

The board of health are now in possession of a new scavenger boat for the disposal of fecal matter from this city. Plans and specifications have been drawn by this department to provide for the disposal of said fecal matter without jeopardizing public health.

The following is the estimate sent to the acting commissioner of public health:

The ACTING COMMISSIONER OF PUBLIC HEALTH, *Manila, P. I.*

SIR: In obedience to your request, I have the honor to submit the following estimate and plan for a platform and dumping station, for the use of the new scavenger of the board of health:

3,000 feet 8-inch beams	\$900. 00
2,000 feet 6-inch beams	400. 00
6,000 feet 1-inch planks	250. 00
8,000 square feet 2-inch planks	250. 00
Bowlders, angle trees, nails	100. 00
Paint	50. 00
Cement and reservoir	330. 00
Miscellaneous, pipe, valve, and fittings	200. 00
One 5-horsepower force pump	150. 00
Labor	1, 500. 00
	<hr/>
	4, 130. 00
15 per cent, engineering and emergency	619. 50
	<hr/>
Total	4, 749. 50

Appropriation required, about \$5,000.

In the present proposed plan the work of dumping into the barge will be entirely odorless; a double room will be constructed as per plan; in the first one pails will be delivered from the cart, and in the second room, or dumping room, a row of eight dumpers will be constructed.

Each pail, or barrel, after the cover is removed, will be placed into the neck of a rubber pipe, according to the diameter, and made fast by means of an iron collar; the said rubber pipe, 12 inches long, will be prolonged by an impermeable canvas pipe, which will itself be fastened to an iron hopper, leading, by means of a 14-inch wrought-iron pipe, into the scavenger compartment.

The only time gas could escape would be the moment the pails or barrels were uncovered, but this will be overcome by means of a 20-inch vent pipe provided with a charcoal fire, which will consume all carbonic gas before reaching the top of the 30-foot vent pipe.

Each dumper is provided with a 2-inch galvanized iron pipe around the circumference of the dumper, and when a pail is emptied the valve is opened and a shower of sea water pumped from the tank of the scavenger is sent into the pail as a first washing.

A small force pump of from 3 to 5 horsepower will be installed at the foot of the pier, and the steam to work the pump will be furnished by the boiler of the boat.

After first being cleaned by means of the sea water, the pails or barrels will be dumped by means of a chute into a cleaning reservoir just below the dumping room; another disinfecting reservoir will be built for the disinfection of pails.

It must be noticed that no gas can find its way out of the building, for the reason that dumping room is independent of receiving room and the gas is consumed in the vent pipe.

The pails, after the first washing by the operation of the valve dumper, will be odorless, and then sent for a last scrubbing into the reservoir. Sea water being itself a disinfectant, this department is confident that no complaint will arise from the dumping along the river bank.

A. JADIN,
Sanitary Engineer, City of Manila.

Plans and specifications for the disposal of sewage from Bilibid Prison have been drawn by this department, and by a special act of the Commission this bureau is ordered to construct immediately said improvement.

Plan and specification for a crematory for the use of the army has been furnished to the chief quartermaster.

The personnel of the bureau consists of the sanitary engineer for the city of Manila, two building sanitary inspectors, and two clerks; to them for the faithful work in the discharge of their various duties my thanks are due.

Respectfully submitted.

A. JADIN.
Sanitary Engineer, City of Manila.

REPORT OF DISBURSING OFFICER, BOARD OF HEALTH, FOR THE YEAR SEPTEMBER 1, 1902, TO AUGUST 31, 1903.

DEPARTMENT OF THE INTERIOR,
BOARD OF HEALTH FOR THE PHILIPPINE ISLANDS,
Manila, September 5, 1903.

SIR: I have the honor to hand you herewith a statement showing the disbursements made by this office for the board of health from September, 1, 1902, to August 31, 1903, inclusive, as requested in your letter of July 3, 1903.

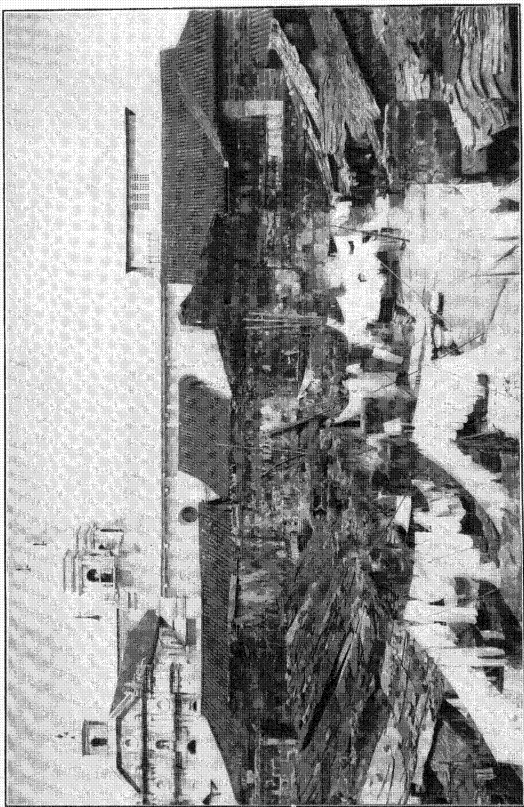
Very respectfully,

F. A. SHERMAN,
Disbursing Officer, Board of Health.

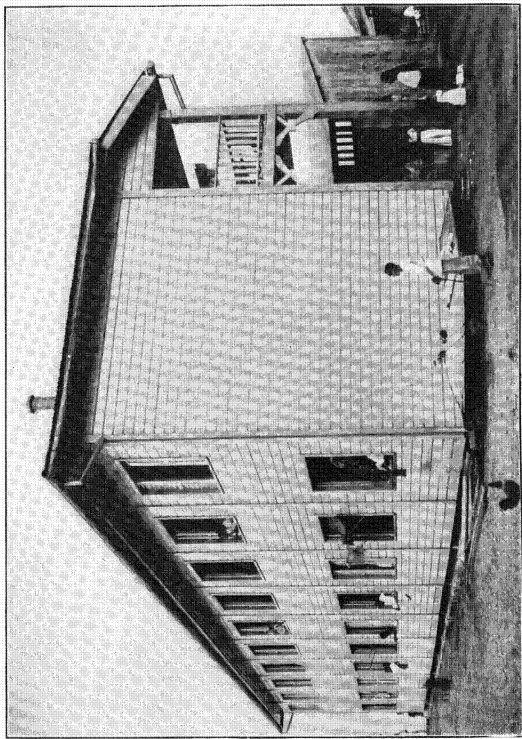
The ACTING COMMISSIONER OF PUBLIC HEALTH, *Manila, P. I.*

Statement of expenditures of the board of health for the Philippine Islands for the year ending August 31, 1903.

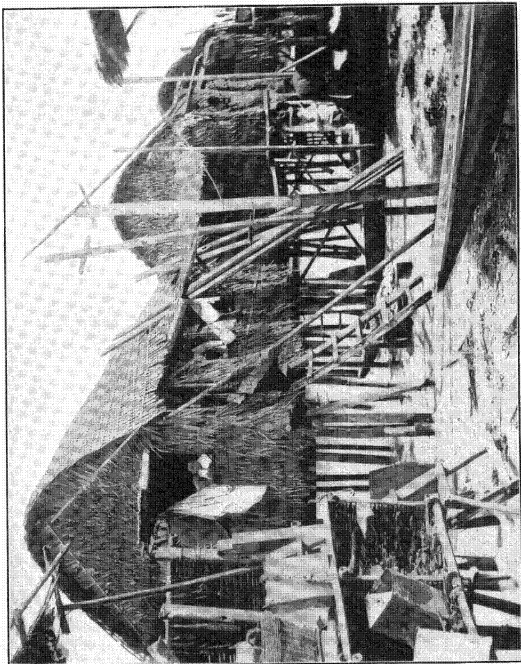
	From Sept. 1, 1902, to June 30, 1903, local cur- rency.	From July 1, 1903, to Aug. 31, 1903, Philippine currency.
Board of health for the Philippines:		
Salaries and wages.....	\$246,025.34	\$47,113.19
Support of hospitals, plants, etc.....	144,394.57	8,137.27
Suppression and extermination of epidemic diseases and pests....	370,326.58	33,180.93
Transportation	66,533.48	2,381.15
Contingent expenses.....	18,558.02	2,643.07
Salaries and wages, indefinite		8,910.68
Installation of the pail system in the city of Manila:		
Salaries and wages.....	95,555.03	11,341.13
Contingent expenses.....	140,860.39	18,183.14
Total.....	1,082,253.41	131,890.56



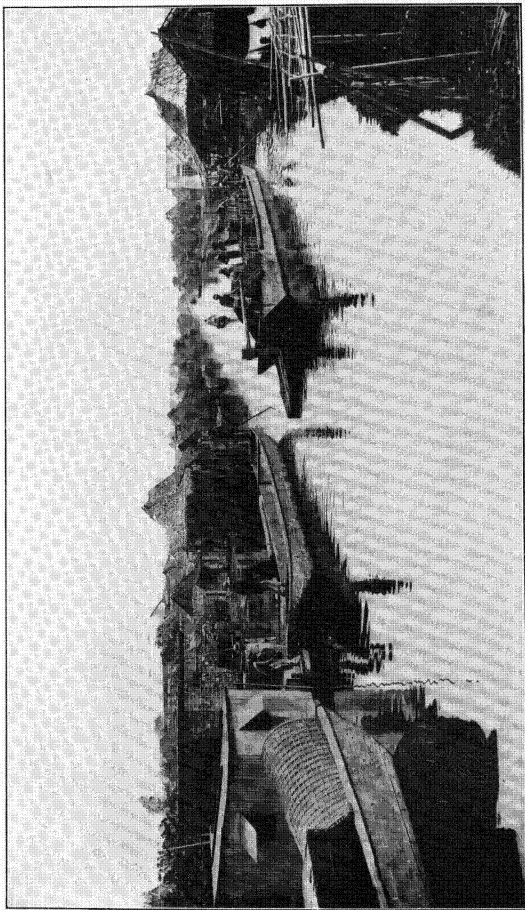
THE "INTERIOR" PROBLEM. TYPICAL INTERIOR IN WALLED CITY.



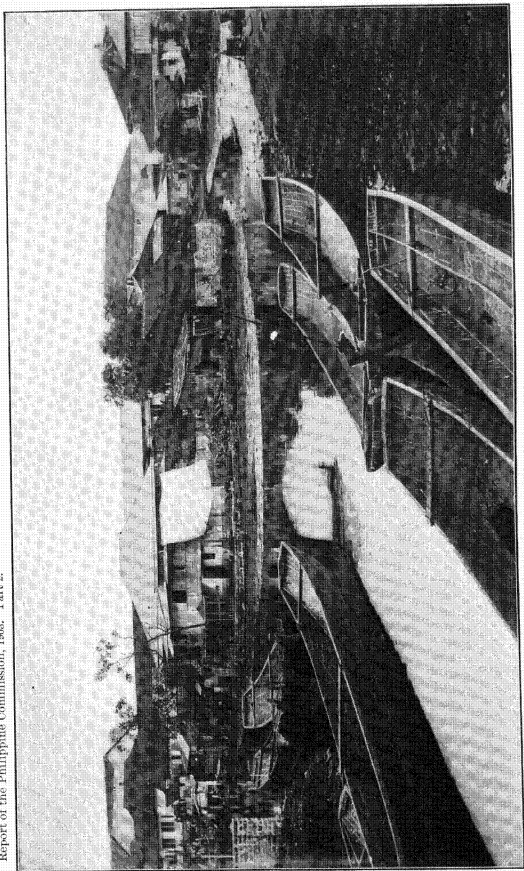
TYPE OF SANITARY TENEMENTS CONSTRUCTED BY THE CITY, DISTRICT OF SAN NICOLAS.



FISHERMEN'S HOUSES ON TONDO BEACH. HIGH TIDE.

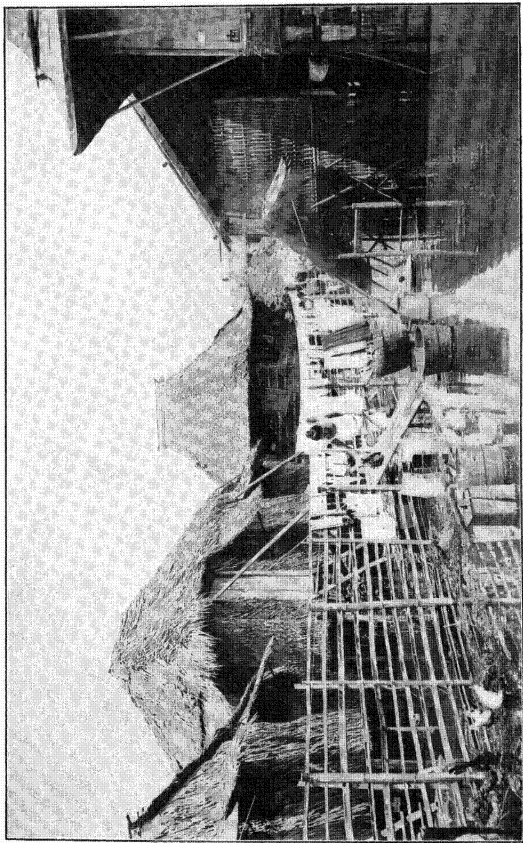


OLD METHOD OF EXCRETA DISPOSAL.



THE "ESTERO PROBLEM." TYPICAL ESTERO AT LOW TIDE.





EFFECT OF HEAVY RAIN IN THE TONDO DISTRICT.

**REPORT OF CASHIER, SHOWING FUNDS RECEIVED BY THE BOARD OF HEALTH
FOR THE YEAR SEPTEMBER 1, 1902, TO SEPTEMBER 1, 1903.**

DEPARTMENT OF THE INTERIOR,
BOARD OF HEALTH FOR THE PHILIPPINE ISLANDS,
Manila, August 31, 1903.

SIR: I have the honor to transmit herewith report of receipts from all sources in the department of public health from September 1, 1902, to September 1, 1903, together with report of deposits of said funds with the insular treasurer and the city assessor and collector.

Very respectfully,

FREDERICK R. RYAN,
Cashier, Board of Health.

Dr. E. L. MUNSON,
Acting Commissioner of Public Health, Manila, P. I.

Funds deposited by the department of health with insular treasurer and city assessor and collector from September 1, 1902, to September 1, 1903.

Month.	Treasurer.		City assessor and collector.		Total.	
	Local currency.	United States currency.	Local currency.	United States currency.	Local currency.	United States currency.
1902.						
September	\$47. 00	\$58. 00	.....	.....	\$47. 00	.....
October	10,723. 44	58. 00	.....	.....	10,723. 44	\$58. 00
November	3,539. 05	108. 95	.....	.....	3,539. 05	108. 95
December	3,877. 06	44. 00	.....	.....	3,877. 06	44. 00
1903.						
January	1,276. 96	80. 15	\$1,570. 41	\$7. 00	2,847. 37	87. 15
February	1,901. 09	125. 00	1,333. 08	48. 00	3,234. 17	173. 00
March	1,269. 70	1,895. 94	887. 36	190. 75	2,157. 06	2,086. 69
April	1,087. 10	368. 61	1,028. 06	92. 50	2,115. 16	461. 11
May	1,439. 92	703. 57	1,366. 31	156. 00	2,806. 23	859. 57
June	869. 82	589. 75	1,231. 16	106. 00	2,100. 98	695. 75
July	637. 84	540. 06	1,089. 35	165. 30	1,727. 19	705. 36
August	693. 56	594. 70	604. 48	283. 25	1,298. 04	877. 95
Total	27,362. 54	5,108. 73	9,110. 21	1,048. 80	36,472. 75	6,157. 53

Funds received by the department of health from all sources from September 1, 1902, to September 1, 1903.

Year.	Burial department.		Veterinary department.		Vaccine virus.	
	Local currency.	United States currency.	Local currency.	United States currency.	Local currency.	United States currency.
1902.						
September	\$1,746. 88	\$23. 51	\$1,317. 31	\$14. 00	\$11. 50	.....
October	1,669. 60	.....	2,068. 00	.....	58. 50	.....
November	1,255. 32	.....	1,359. 18	85. 45	10. 00	.....
December	1,200. 29	106. 65	1,959. 86	44. 00	.....	\$912. 54
1903.						
January	1,570. 41	7. 00	1,926. 83	80. 15	10. 50	.....
February	1,379. 64	48. 15	1,298. 99	179. 00	37. 43	75. 00
March	928. 11	272. 25	1,071. 68	559. 92	78. 66	418. 28
April	1,226. 85	63. 25	1,066. 47	280. 45	46. 50	257. 51
May	1,257. 68	120. 75	740. 88	360. 45	154. 13	129. 77
June	1,163. 32	93. 50	782. 65	371. 35	6. 08	150. 90
July	1,074. 72	355. 60	649. 47	394. 50	9. 73	70. 50
August	573. 44	330. 25	414. 92	493. 33	6. 00	39. 30
Total	15,046. 16	1,420. 91	14,646. 24	1,972. 60	429. 03	2,053. 80

Funds received by the department of health from all sources from September 1, 1902, to September 1, 1903—Continued.

Year.	Subsistence.		San Lazaro hospital.	Commis- saries.	Totals.	
	Local cur- rency.	United States currency.	Local cur- rency.	United States currency.	Local cur- rency.	United States currency.
1902.						
September					\$3, 075. 69	\$37. 51
October	\$33. 60				3, 829. 60	
November	123. 75				2, 748. 25	85. 45
December	88. 40				3, 248. 55	1, 063. 19
1903.						
January	158. 50				3, 666. 34	87. 15
February	123. 69				2, 839. 75	302. 15
March	74. 48				2, 152. 93	1, 250. 45
April	80. 60				2, 410. 42	611. 21
May		\$27. 50	\$190. 30		2, 342. 99	638. 47
June		15. 50			1, 952. 05	631. 25
July	42. 88	30. 50		\$112. 46	1, 776. 80	963. 66
August		15. 50			994. 36	878. 38
Total	726. 00	89. 00	190. 30	112. 46	31, 037. 73	6, 548. 77

REPORTS ON THE OPERATION OF THE PAIL CONSERVANCY SYSTEM IN THE CITY OF MANILA AND THE TOWN OF MARIQUINA, BY THE SUPERINTENDENT OF THE SYSTEM.

OFFICE OF THE SUPERINTENDENT OF THE PAIL CONSERVANCY SYSTEM,
Manila, P. I., August 1, 1903.

SIR: I have the honor to submit the following report of the work accomplished by this department since July 1, 1902, until the 1st of August, 1903, up to and including this date:

Nine thousand four hundred and eighty-nine inspections were made and reports rendered on sanitary conditions of closets. Orders to repair closets were sent out to property owners where repairs were possible, and of these orders 2,252 have been complied with satisfactorily where repairs were permissible, in other places where repairs were not permissible closets were ordered torn out and pails installed in their stead. On this date 1,493 pail-system seats have been installed, and during the corresponding period a grand total of 384,696 pails have been removed, cleansed, disinfected, at a total cost of practically \$38,195.47 Mexican currency, or an average of \$0.0999 per pail per day. There has been repaired during this period 1,400 pails and 558 commodes in the pail system repair shops. There has been excavated by the odorless excavators 2,547 loads of excrement from government closets, making a total of 1,273,500 gallons of fecal matter. There has been collected from private parties for pail system expenses \$26,103.27 Mexican currency and \$317.85 United States currency. Charges against the city of Manila and various public departments aggregate \$45,732.21 more in Mexican currency.

It was not intended when the pail system was first organized to order repairs to closets and latrines from the pail system office, but in view of the fact that in making inspections with a view to installing the pail system the necessary data was obtained for ordering repair work, that work was also given over to this office by the board of health, and besides acting upon the inspections made by our own overseers we have in the past been passing upon the inspections made by the sanitary force of the board of health—instructions having been given that force through Mr. Osgood, the sanitary engineer.

In addition to this the regular routine office work has been done, including daily record of pails cleaned from each installation and record of trips made by cleaning cascoes, wagons, etc., notices, bills, and receipts made out and money collected for the installation and cleaning of pail system installations, cleaning of vaults, repair of closets under provisions of ordinance No. 9, regular property papers, etc.

During the month of July, 1902, the old Trozo Barracks were fitted up for use of the pail system, all the buildings being placed in a proper state of repair, blacksmith shop, carpenter shop, storeroom, quarters for teamsters, and an office were fitted up and a large wagon shed was built. During the month of August, one of the pail system cascoes was equipped with a tank having a capacity of 3,500 gallons, to be used in connection with the odorless excavators, and many minor repairs and improvements to the pail system apparatus were completed.

During the month of September two wharves were built on the Estero de la Reina, one for loading and unloading pails—this wharf being 20 by 30 feet; and a wharf 35 by 45 feet, fitted with the proper approaches, was built for use of the odorless excavators; an office was built at the central station for the use of the foreman; seventy temporary commodores were built in the carpenter shop and were used in making urgent installations.

During the month of October the first of the new wooden pails were installed, a total of 383 installations being made, and a new tank banco, with a capacity of 4,500 gallons, was built for the use of the excavators; odorless excavator wagons were repaired and painted, and numberless repairs and other small improvements were made.

During the month of October the question arose of making the charge for the cleaning of pails to include the cost of the office force. It was suggested to the honorable secretary of the interior that as the cost of the office force (or civil service employees) was \$2,607.60 gold per month, or \$2.96 Mexican currency at the legal rate per pail, figuring on the basis of 880 installations, the actual amount placed on that date, and as the actual cost of cleaning the pails with bull carts and cascoes and other primitive methods was \$3.06 Mexican, a total of \$6.02 Mexican, while the entire estimated cost when installations was completed was \$2.80 Mexican, including all running expenses of all departments, that this newly suggested rate of \$6.02 would place an unjustifiable burden upon the property owner. It was also submitted at that time that it was hardly fair to the property owners concerned in the installations already made that they should pay pro rata for the office force at that time, as there were but 880 installations made out of 6,000, and the office work at that time involved preliminary installation of the entire 6,000 installations. These suggestions were approved by the honorable secretary of the interior and the matter of raising the cleaning charge was dropped forthwith.

On January 1, 1903, the office force was reorganized, and the position of collector was abolished, and the position of clerk \$900 and clerk \$420 were authorized in their stead, thus making a saving in the office of \$2,280 per annum.

The regular routine work of making inspections, etc., was continued until the month of May, 1903. In that month the superintendent of the pail system received orders from the commissioner of public health to install the pail system in the city of Mariquina as a precaution against cholera, as it was feared that the Mariquina River might become contaminated with fecal matter, thus creating an epidemic in the city of Manila. The superintendent of the pail system was detailed for this work, and placed 200 public installations in Mariquina, placing same under the direction of Mr. Jose Reynoso.

On May 19, 1903, all of the buildings and most of the property belonging to the pail system were destroyed in the great Troso fire, sufficient property only being saved to continue the work of the pail-system installations already placed, in a more or less temporary manner. This loss involved six 4-horse trucks, 3,988 sets pails, 3,846 commodores, and sundry stores, office furniture, records, etc., thereby greatly crippling the department.

Estimates have been made and money appropriated for the continuance of the pail system, and the work of reconstruction is going along as rapidly as possible.

A sanitary steam barge, designed for the purpose of properly disposing of fecal matter, has been built by Farnham, Boyd & Co., at a cost of, approximately, \$44,000 United States currency, and same is now about to be placed in commission.

The odorless excavators are at present in a very bad state. This will be remedied when the new excavators, which have been ordered, arrive. It is considered that the odorless excavators are invaluable for the work of cleaning the vaults in the city, and it is suggested that owing to the constant complaint made by the sanitary inspectors from the various districts in re private contractors, that it would be advisable to purchase a sufficient number of excavators, say 20, and do the entire work of the city in place of the public vaults only, as is done at present.

Respectfully submitted.

B. H. BURRELL,
Superintendent of the Pail System.

The COMMISSIONER OF PUBLIC HEALTH, Manila, P. I.

OFFICE OF THE PAIL SYSTEM,
Manila, P. I., June 6, 1903.

SIR: I have the honor to submit the following data in regard to the installation of the pail system in the city of Manila.

It is an admitted fact that the pail system is not an unqualified success as placed in private houses, for the following reasons:

First and foremost, would state that there is no ordinance to compel tenants to prepare a proper place for pails or to keep seats and surroundings clean after the installation is made, other than a general sanitary ordinance, which does not apply directly, neither can it be enforced.

Second. The filthy habits of the tenants and users of pails in private houses are not conducive of sanitary conditions, for reasons for which it will not be necessary to state. Aside from this, contempt is shown the pail system employees by the users of pails, especially when orders or requests are given to clean up.

Third. It was a mistake to make a cheap commode of Oregon pine of inferior workmanship and material throughout, for reasons of economy only. This commode will not stand rough usage and is readily impregnated with all the foulness that inevitably accumulates daily owing to the filthiness of the Filipino and Chinese users.

I would point out to the commissioner a great number of installations used by Americans and upper-class Mestizos where absolutely no complaint has been made, and where, in fact, no cause for complaint exists, for the reason that the users are intelligent and understand the proper function of sanitary appliances.

If pails are to remain in private houses there must be an ordinance which will compel owners or tenants to keep the seats and surroundings in a sanitary condition, with an appropriate penalty for noncompliance.

REASONS FOR THE SUCCESS OF THE PUBLIC-CLOSET SYSTEM.

In the first place, the buildings in use were especially built for this purpose, with a view to the maintenance of proper sanitary conditions. Each public closet is under the direction of a caretaker at all times; this caretaker enforces a set of regulations which prohibit any misuse of closets; the closets are kept scrupulously clean at all times; the seats and floor are washed twice daily with a disinfectant, and as many times thereafter as may be necessary; deposits are disinfected every two hours; standing on the seats is prohibited, and the prohibition is strictly enforced.

The strictest surveillance has made it possible to remove from 50 to 70 pails daily from a closet which has a seating capacity of 20 only, and this is done with absolutely no complaint from either the users, sanitary authorities, or neighbors.

The present midden sheds cost in the neighborhood of \$30 gold per seat, with a capacity of 100 people, figuring on three changes of pails daily. On this basis of figuring (should public closets be erected throughout the city), with the 5,000 sets of pails for which appropriation has been asked, we could easily accommodate 150,000 people, or more than one-half the population of Manila, or in other words, completely taking care of the nipa and poorer districts of the city at an initial cost for midden sheds of about \$55,000 United States currency. In this connection would suggest that midden sheds of 5, 10, and 15 seats each should be constructed throughout the outlying and congested districts of the city; that the same be grouped, each group to be in charge of a native foreman and a sufficient number of caretakers; in fact that the same system that obtains in regard to the existing public closets be maintained. This system will permit of a very considerable reduction in the office force and also a corresponding reduction in the operating expenses owing to the concentration of installations.

If private installations are removed, it will necessitate the passage of an act by the civil commission authorizing reimbursement for installation charges to all private parties having paid the same, or at least to those who have used the pail system for less than a stated period, say six months. I think that the cleaning charge already collected is a proper charge, and that no reimbursement for money so paid in should be made.

Since the inception of the pail system in the city of Manila this department has made all inspections necessary for the repairs or condemnation of existing closets and the installation of the pail system, issuing orders for the same, and making the necessary inspections for the completion of said orders. This work was never rightly in the province of this department, and was only taken up on the recommendation of the former commissioner of public health during the height of the cholera epidemic last year, at which time it was impossible for the sanitary inspectors to do this work. If the installation of pails in private houses is abolished, and if the inspections of vaults, closets, etc., is taken out of the hands of this department, as should be done, it will admit of a very considerable reduction in the office force of the pail system, but a corresponding increase in some other department of the board of health. It will be necessary also in that case to oblige the present users of the pail system in private houses to construct sanitary closets of approved design. This matter will

take some little time; that is to say, it would not be possible to drop installations in a private house at a moment's notice.

There are many houses where the pail system is installed at the present time which are not of sufficient value to warrant the outlay of any considerable sum for the construction of a proper sanitary closet. Some special provision will have to be made for these places, probably by constructing a public closet at some point nearby where the same would accommodate the tenants of a number of these houses. Public closets, if built in resident and business districts, would necessarily have to be of a more ornate design than the present public midden sheds, which were constructed for utility only without any attempt at ornamentation. A suitable design for public closets in these districts, with estimated cost, should be prepared.

The accompanying estimate for contingent expenses, installation of pail system, will not be changed other than by the addition of a sufficient sum to construct public closets, whether the present system is continued or the system of public closets be established. The only change will be in the personnel of the pail system, as per copy submitted.

In conclusion, I would like to put in a good word for the wooden pail at present in use by the pail system. A complete change in the manner of cleaning and disinfecting pails within the last two months has demonstrated the fact that by the discontinuance of the use of carbolic acid and the substitution of milk of lime, the disagreeable odor formerly noticed has been almost entirely eliminated. This removal of odor is also in part due to a frequent painting inside with crude coal tar and could probably further be reduced by painting the pails outside as well as inside with the same material. Would state in this connection that with this manner of disinfecting and deodorizing, it is found that there is barely any perceptible odor from pails so treated.

If the public-closet system is established, it will of course be possible to do all collection at night—something which can not be done at present with the private installations. In this way the principal objection to the wooden pails will be removed entirely.

In regard to transportation, would state that there is a considerable balance in favor of bull carts over platform trucks, both in initial cost and running expenses.

Memorandum of comparative cost of wagons and bull carts.

[Basis: Actual usage shows three carts equal to one wagon.]

WAGON COST.		THREE CARTS COST.	
	U. S. currency.		U. S. currency.
1 wagon	\$550	3 carts	\$198. 81
3 horses	720	3 carabao, at \$100	300. 00
3 sets harness	120	3 rack frames	14. 25
	<hr/> 1, 390		<hr/> 513. 06

Difference each wagon or equivalent, \$876.94.

RUNNING EXPENSES ONE MONTH.

	U. S. currency.		U. S. currency.
1 teamster	\$70. 00	3 drivers, at \$15	\$45. 00
Hay, 3 horses	20. 52	3 carabao, tic-tic and grass	27. 60
Oats, 3 horses	20. 16	Repairs to cart	2. 50
Repairs, wagon	5. 00		<hr/> 75. 10
Shoeing once all around	9. 00		
	<hr/> 124. 68		

Difference each wagon or equivalent, \$49.58

Would point out also that this department lost 12 American animals from surra and glanders during the past year. Loss of this character would be eliminated to a great extent by employing immune carabao.

I have the honor to remain, very respectfully,

B. H. BURRELL,
Superintendent of Pail System.

The COMMISSIONER OF PUBLIC HEALTH,
Manila, P. I.

OFFICE OF THE PAIL SYSTEM,
Manila, P. I., June 4, 1903.

SIR: I have the honor to make the following report in regard to the installation of the pail system at Mariquina:

Pursuant to instructions issued by the commissioner of public health, I proceeded to Mariquina on May 3, 1903, taking with me 100 sets of pails and 100 commodes, as well as various pail-system supplies. Pursuant to instructions, I also took with me Mr. Jose Reynoso, assistant overseer of pail system, to act as superintendent of the pail system at Mariquina. After a preliminary survey of the town, I estimated that at least 200 sets of pails would be needed instead of 100, and also that the total cost of installation would amount to \$700, local currency.

The work of erecting the public latrines began on the morning of May 7 and was completed on May 29, on which date the installation of 200 seats was completed. There are established at present:

24 public closets of 1 seat,
45 public closets of 2 seats,
7 public closets of 4 seats,
1 public closet of 5 seats,
a total of 147 seats. In addition to this, there are installed in private houses 53 seats, making a total of 200 seats.

The itemized cost of installation is as follows:

	Local currency.
10 carpenters, at \$1 daily	\$185. 00
20,000 nipa	120. 00
400 cane	130. 00
Bejuco	38. 00
Transportation for 200 sets pails and 100 commodes from Manila to Mariquina.....	42. 25
Hire of 1 carromata from the 3d to the 19th day of May, inclusive.....	68. 00
To reimbursement for board for self for 17 days	51. 00
Total	634. 25

leaving a balance of money estimated of \$65.75.

The above expense is chargeable to the installation of the pail system at Mariquina.

The expense for the month of May for collection and cleaning is as follows:

	Local currency.
11 laborers from 2 days to 26 days each, at from 80 cents to \$1.....	\$183. 00
Bull cart hire from the 7th to the 31st of May, inclusive.....	156. 00
Vehicle hire for Jose Reynoso from the 3d to the 31st day of May.....	72. 50
Reimbursement for board Jose Reynoso from 3d to 31st of May.....	43. 50
4 cases of bleaching powder.....	39. 20
5 gallons coal tar	2. 95
Stationery	1. 00

A total of \$498.15, local currency, actually expended.

The expense of maintaining the system will be as follows per month:

	Local currency.
12 laborers, at \$1 per day	\$360. 00
4 bull carts, at \$3 per day	360. 00
Vehicle hire for acting superintendent.....	75. 00
Reimbursement for board for acting superintendent (for month of June only)	45. 00
4 cases bleaching powder.....	39. 20
5 gallons coal tar	2. 95
Repairs to public latrines.....	10. 00
Repairs to pails and commodes	5. 00
Stationery	1. 00

A total of \$898.15 local currency.

The expense of maintaining the system will be as follows per month:

It is expected that Mr. Jose Reynoso will be transferred from the position of assistant overseer of pail system to the position of superintendent of pail system at Mariquina, at a salary of \$600 per annum, United States currency. From the date of his appointment reimbursement for board will cease.

It was thought at first that laborers could be hired in Mariquina at 80 cents, local currency, daily. It has been found, however, that the laborers of Mariquina do not take kindly to this work at any price and it has been found necessary to substitute laborers from Manila at \$1, local currency, daily.

I wish to state that I have received absolutely no assistance from either the officials of the town of Mariquina, the health board of the province of Rizal, nor any other official in the province of Rizal, aside from promises without result. The sanitary force of Mariquina is ineffective in every way so far as I can find out. There have been no ordinances, circulars, or instructions issued by the town authorities in Mariquina for the maintenance of the pail system, or for any other sanitary measure.

It is absolutely necessary before the rainy season sets in to construct a short temporary bridge across a cut or slough situated at the northern end of the barrio Bayambayano, on the road that leads from said barrio to Sampang Kutkut, as the present dumping place will be impracticable as soon as the rains set in. This bridge will cost in the neighborhood of 200 pesos.

It is suggested by the contract surgeon stationed at Mariquina that a footpath along the banks of the Mariquina River is absolutely necessary for the proper observance of quarantine regulations. The river patrols at present are obliged to pass through the main streets of the town, instead of being able to patrol along the river banks, where their services would be more effective.

The contemplated sanitary force of 12 men has not as yet been organized, and, so far as I can learn, no steps have been taken toward the organization of this force.

I have the honor to request that the matter of the footpath, passage of proper sanitary laws or ordinances, the building of the bridge herein mentioned, and the organization of the sanitary force receive early consideration at the hands of the commissioner of public health as the provincial and municipal authorities are completely inactive.

Respectfully submitted.

B. H. BURRELL,

Superintendent of the Pail System, in charge of Mariquina.

The COMMISSIONER OF PUBLIC HEALTH,
Manila, P. I.

Skeleton report on pail system from July, 1902, to September 1, 1903.

	Inspec- tions.	Closets repaired.	Seats in- stalled.	Pails cleaned.	Cost work- ing force.	Per pail.
1902.						
July.....				10,727		
August.....				12,664		
September.....				12,338		
October.....				17,983		
November.....				27,958		
December.....	6,262	1,092	1,073	29,961	\$10,721.34	\$0.096
1903.						
January.....	982	162	100	34,372	3,451.50	.10
February.....	183	85	63	34,022	3,236.00	.095
March.....	893	322	27	38,010	4,058.33	.107
April.....	726	391	123	38,691	4,003.00	.103
May.....	320	156	88	43,158	4,626.00	.107
June.....	123	44	4	41,901	4,154.00	.099
July.....			15	42,911	a 3,945.30	.092
August.....			2	42,241	4,241.60	.10
Total.....	{ 9,489	{ 2,252	{ 1,495	{ 426,937	b 34,252.17 c 8,186.90	.0999 .10

a Conant.

b Mexican currency.

c Philippine currency.

Skeleton report on pail system from July, 1902, to September 1, 1903—Continued.

	Pails repaired.	Com-modes repaired d.	Collected.	Excavator loads.	Excavator gallons.	Remarks.
1902.						
December.....	275	113	{ a \$7,842.06 b 10.00 }	1,098	549,000	Summary for 6 months.
1903.						
January.....	140	21	{ a 3,169.61 b 96.46 }	225	112,500	
February.....	112	46	{ a 2,259.55 b 73.68 }	184	92,000	
March.....	134	90	{ a 2,487.53 b 30.98 }	.....	109,500	
April.....	216	73	{ a 2,459.36 b 43.40 }	.....	95,700	
May.....	237	64	{ a 3,072.48 b 41.90 }	.....	100,000	
June.....	236	111	{ a 2,894.64 b 21.33 }	.....	113,500	
July.....	50	40	{ a 1,918.04 b 281.91 }	206	103,000	
August.....	250	42	{ c 1,815.99 }	189	94,500	
Total.....	1,650	600	{ d 317.85 a 281.91 c 27,919.76 }	2,756	1,318,700	

a Philippine currency.

b Gold.

c Mexican currency.

d United States currency.

REPORT OF PHYSICIAN IN CHARGE SAN LAZARO HOSPITAL.

SAN LAZARO HOSPITAL,
Manila, P. I., September 1, 1903.

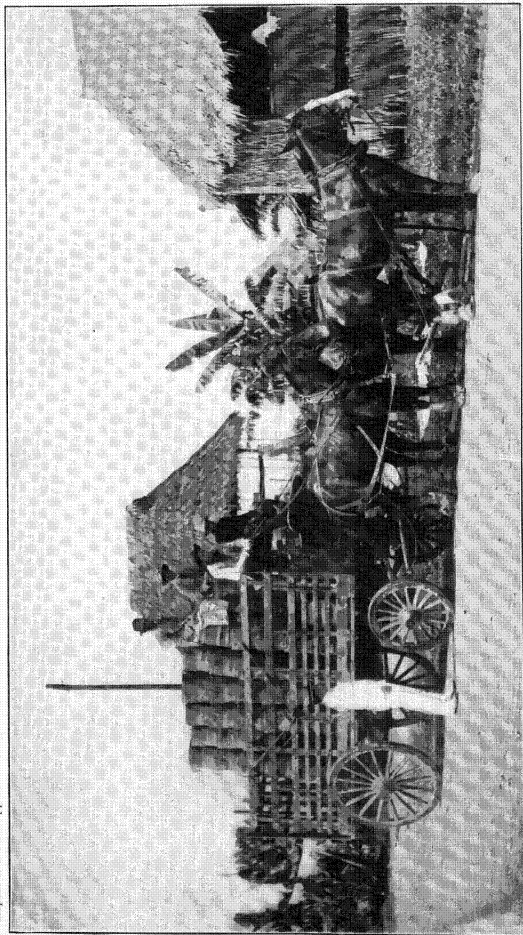
SIR: I have the honor to make the following report of the work done in this hospital since its consolidation in March last, and also as complete a report as can be obtained from the rather imperfect record of its several component parts during the previous six months, from September 1, 1902, to March 1, 1903, so that the following purports to be an annual report of the present departments of San Lazaro Hospital, each of which was run as an independent hospital from September 1 to March 1 and as departments of one consolidated hospital from March 1 to September 1.

As now organized, San Lazaro Hospital is composed of the women's, leper, bubonic plague, smallpox, cholera, and morgue departments, each having its own appropriation and assignment of nurses and employees, but so arranged that their supplies can be bought in common and their employees shifted from one department to another, as the greater or less demand for help varies with the varying number of patients in each. This is productive of a degree of economy that could not obtain with the several departments run independently, as formerly. Also the books and records are kept in one office, the drugs kept and compounded in one central drug room, and the commissaries drawn and stored together, all of which is conducive to economy and careful oversight.

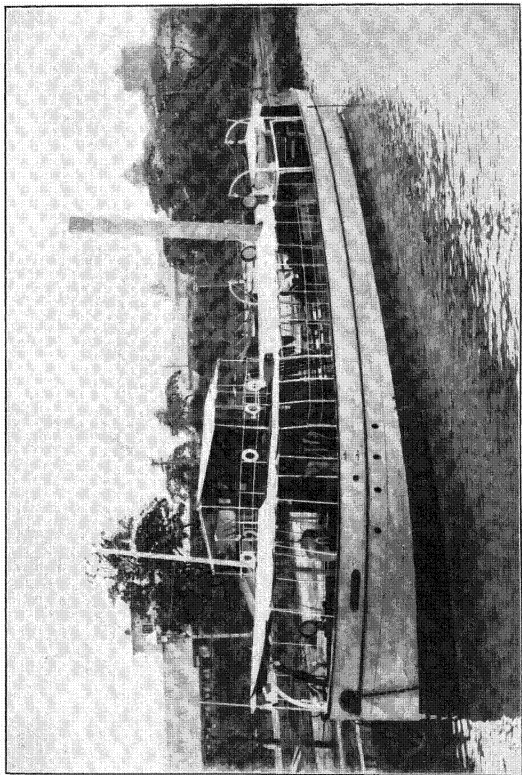
There are three kitchens and dining rooms—one for the women's department, one for the leper department, and one for the bubonic plague, smallpox, and morgue departments. This division for subsistence is a natural one, both on account of the location of the respective buildings and on account of the character of the diseases treated in them. Each division has a doctor assigned to it—Doctor Fairbanks on the women's wards, Doctor Mercado on the leper wards, and Doctor Ampil together with myself doing the work on the cholera, smallpox, and plague wards.

I am glad to say that since my report of March 31 most of the improvements recommended have been completed or are well started.

Comfortable hard-wood wards to accommodate a reasonable number of cholera, plague, and smallpox cases are being constructed on the site of the old detention camp, within the main walls, and in two months will be ready for occupation. A good steam disinfecting plant has been placed on the grounds. A new and well-equipped morgue has been constructed and the material for a crematory is now on the grounds. An appropriation has been made for a complete sewer system and plans are now being drawn for its construction. The kitchen, dining rooms, toilets and baths of the women's department have been remodeled and the kitchen and operating room made fly proof, while the interior of all the wards have been repainted. New and improved roadways are now being constructed to the various departments and the grounds are being gradually beautified by the addition of trees and flowers.



COLLECTING DRAY, PAIL CONSERVANCY SYSTEM.



SANITARY DUMPING BARGE OF PAIL CONSERVANCY SYSTEM, 285 TONS BURDEN.

Still I am very sorry to have to report that it has been impossible to have my most urgent recommendation complied with. This was to remove the cattle, carabao, and vaccine calves belonging to the serum laboratory from within the walls, as they increase to a marked extent the flies which scatter our various infectious diseases. To the contrary, the number of cattle has been gradually increased, and I am told that their removal is to be accomplished in the future, near or distant, but I can not understand how any commercial necessity can justify this disregard of health precautions.

It is impossible to give the per diem cost of subsistence for the past year on account of the various managements under which the institution has been, but the per diem cost for the month of July was 21 cents United States currency.

The personnel of the entire hospital on this date is 4 doctors, 1 superintendent, 1 drug-gist, 1 clerk, 1 chief sanitary inspector, and 72 employees, including matrons, nurses, cooks, laundresses, laborers, and servants. There are 281 patients present to-day.

Below will be found a summary of the work done in each of the several departments during the past year.

1. *Women's department.*—This department has been in operation since the early military government began, and since the change has been continued by the civil government.

In it are treated all public prostitutes found diseased and sent in by the medical inspector of Sampaloc district. Up to February 11 this work of inspecting the district and afterwards treating the diseased women was combined under the doctors of the women's department, but since that date the medical inspector of Sampaloc district has had charge of the work in the district, while the work in the hospital has been separate and independent, which affords the advantage of making each a check upon the other, as well as relieving the hospital of all responsibility outside of its gate.

On March 21 one of the native women who had been in the ward four days was taken with smallpox and removed to the smallpox department. The women's department was quarantined and all women who had not been successfully vaccinated within the preceding three months were vaccinated. During the following 89 days 12 women were taken with the same disease and we had to keep them in quarantine for 82 days. Fortunately all of the cases were extremely mild, not causing as much discomfort as an ordinary bad cold, and, strange to say, three of the cases had good vaccination scars produced by vaccination during the month, and also were well pitted by previous attacks of smallpox.

During the past year 1,167 cases of venereal disease have been admitted or brought forward from last year, 1,049 discharged cured, 16 discharged uncured, 28 transferred to other hospitals, departments of this hospital, or to the custody of the police, and 74 remain in the institution.

Month.		Remain- ing last report.	Admit- ted.	Dis- charged cured.	Dis- charged uncured.	Trans- ferred.	Number remain- ing.
1902.							
September.....	Filipinos	105	55	87	.....	1	72
	Japanese	25	17	27	.....	.....	15
	Others	5	1	5	.....	.....	1
Total		135	73	119	.....	1	88
October	Filipinos	72	23	55	.....	.....	40
	Japanese	15	19	21	.....	.....	13
	Others	1	.....	1	.....	.....	.....
Total		88	42	77	.....	.....	53
November	Filipinos	40	20	39	.....	.....	21
	Japanese	13	15	21	.....	.....	7
	Others .....	.....	2	1	.....	.....	1
Total		53	37	61	.....	.....	29
December	Filipinos	21	26	25	.....	.....	22
	Japanese	7	7	12	.....	.....	2
	Others	1	1	2	.....	.....	.....
Total		29	34	39	.....	.....	24
1903.							
January	Filipinos	22	57	40	.....	.....	39
	Japanese	2	69	52	.....	.....	19
	Others .....	.....	9	1	.....	.....	8
Total		24	135	93	.....	.....	66

Month.		Remain- ing last report.	Admit- ted.	Dis- charged cured.	Dis- charged uncured.	Trans- ferred.	Number remain- ing.
1903.							
February	Filipinos	39	61	14			86
	Japanese	19	88	14			93
	Others	8	31	6			33
Total		66	180	34			212
March	Filipinos	86	38	23		1	100
	Japanese	93	54	64			83
	Others	33	9	22	5	1	14
Total		212	101	109	5	2	197
April	Filipinos	100	36	26		13	97
	Japanese	83	68	70	1	2	78
	Others	14	17	18	7		6
Total		197	121	114	8	15	181
May	Filipinos	97	4	56		3	42
	Japanese	78		63			15
	Others	6		6			
Total		181	4	125		3	57
June	Filipinos	42	58	13		1	86
	Japanese	15	84	19		1	79
	Others		15				15
Total		57	157	32		2	180
July	Filipinos	86	26	53			59
	Japanese	79	49	86		2	40
	Others	15	8	20			3
Total		180	83	159		2	102
August	Filipinos	59	31	44		3	43
	Japanese	40	31	40	2		29
	Others	3	2	3	1		2
Total		102	65	87	3	3	74

The diagnosis of completed cases between September 1, 1902, and August 31, 1903, is as follows:

	Gonor- rhea.	Syphilis.	Chancre.	Gonorrhea and chancre.	Found not diseased.	Total.
September	96	1	18	2	3	120
October	53		19	2	3	77
November	50		5	4	2	61
December	27	1	9	1	1	39
January	84	1	6	2		93
February	31	1		2		34
March	111		4	1		116
April	134		3			137
May	120	1	4	3		128
June	30			2	2	34
July	151	1	2	7		161
August	74	5	3	11		93
Total	961	11	73	37	11	1,093

Of the 120 discharged in September, the average time in hospital was 46 days.

Of the 77 discharged in October, the average time in hospital was 39 days.

Of the 61 discharged in November, the average time in hospital was 42 days.

Of the 39 discharged in December, the average time in hospital was 38 days.

Of the 93 discharged in January, the average time in hospital was 16 days.

Of the 34 discharged in February, the average time in hospital was 17 days.

Of the 116 discharged in March, the average time in hospital was 21 days.

Of the 137 discharged in April, the average time in hospital was 37 days.

Of the 128 discharged in May, the average time in hospital was 50 days.

Of the 34 discharged in June, the average time in hospital was 55 days.

Of the 161 discharged in July, the average time in hospital was 35 days.

Of the 93 discharged in August, the average time in hospital was 54 days.

Total completed cases, 1,093.

Average time in hospital of total discharged during year, 37 days.

The average time spent in the hospital has been increased very much by several chronic chancroidal cases and also by quarantine restrictions under which we could discharge no one.

As can be seen from the above tables, the number of admissions from the district has greatly decreased since June when the institution was reopened after an extended period of quarantine. Before this we had not, since our systematic work began in February, ever been able to take in all of the applicants for admission. This is very favorable, as I have no reason to believe that the work in the district is not being done as carefully now as in February and March, when we were unable to take in all of the cases, although we ran up to 215, while now we have only 74 in the institution, and still the number discharged each week is greater than the number admitted. These cases, tabulated as "Discharged uncured," were discharged on the condition that they should leave the islands within twenty-four hours.

2. *Leper department.*—The lepers are characterized by their uniformity of customs and numbers and the gradual progress of the disease. They die only as the rest of us, when they are overtaken by some outside disease, such as tuberculosis, nephritis, heart disease, or old age. They rarely or never get well, but are usually fairly content and happy, especially since the rumor of their removal to Culion has faded away.

On September 1, 1903, there were 185 patients in this department; there have been 91 admitted during the year, 7 of whom were discharged at once with diagnosis of "not leprosy." During the year 14 have died, 46 escaped (of the escapes 7 have been readmitted and are carried with those admitted), and 5 have been transferred to China. There remain in the institution to-day 202, as follows: 93 men, 78 women, 22 boys under 15 years of age, and 9 girls under 15 years of age.

The building now occupied by the lepers is ample in size and reasonably well appointed to accommodate 225 patients. The baths and closets are not as good as they should be, but an appropriation is available for the reconstruction of these and plans are being drawn for the same.

All of the employees in this department are lepers, except the physician and two servants for outside work and to run errands.

3. *Bubonic plague department.*—This department now occupies a poorly constructed building outside of our San Lazaro wall, but within the next two months, when the new cholera buildings are completed, we hope to be able to occupy one of these buildings, as they have been designed with this in view, and should no general epidemic of either of the three highly infectious diseases (cholera, smallpox, and plague) the referred to new buildings will be ample for all these cases.

During the past year the following cases of plague have been treated in this hospital:

Month.	Remain- ing last report.	Admit- ted.	Diagnosed not plague.	Died.	Recov- ered.	Number remain- ing.
October.....		1		1		
December.....		1		1		
January.....		1		1		
February.....		8		5		
March.....	3	17	3	9		3
April.....	8	9	2	5	3	7
May.....	7	10	4	3	4	6
June.....	6	5	1	5	5	
July.....		1	1			
August.....		3		2		1
Total.....		56	11	32	12	

As will be seen, the mortality for the past year has been 71 per cent, or 32 deaths out of 45 cases treated; this is after deducting the cases of doubtful or erroneous diagnosis. Practically the only treatment has been the hypodermatic injection of "antipest serum" from the Imperial Government Serum Institute of Japan. This treatment in my opinion has done good and saved a number of lives. Before my taking charge of this department in March, serum had not been used with any regularity, and the death rate had been 100 per cent, or 8 deaths out of 8 cases treated; since that time 37 cases have been treated with a death rate of 65 per cent, or 24 out of 37 cases treated. For three months past we have had but few cases; still we have lost them all, although serum has been used systematically, but without effect. I attribute this to the fact that the serum used was old and had lost its activity. Later we tried the serum made by our government serum laboratory on two cases without result.

4. *Smallpox department.*—This is also at present located outside the wall, but as well as the plague department we hope to remove it soon to one of the new buildings being constructed within the walls.

Below will be found a tabular list of the cases treated during the year.

Month.	Remain- ing last report.	Admit- ted.	Diagnosed not smallpox.	Died.	Dis- charged.	Number remain- ing.
October		2		1	1	
December		2		1		1
January	1				1	
February		8				7
March	7	19		3	10	13
April	13	27	2	3	12	23
May	23	22	1	1	29	14
June	14	10		2	14	8
July	8	6	1		8	5
August	5	3		1	5	2
Total		99	4	12	81	

The mortality from this disease has been 12 deaths out of 95 cases treated, or 12 per cent. Of the total number treated, 82 were natives, 2 Chinese, 1 Spaniard, 5 Americans, and 5 others. Four of the Americans died. Six Filipinos were deeply pitted by previous attacks. Most of the natives had very mild attacks while all the Americans, except one had it in violent form. The treatment has been symptomatic and keeping the skin clean and antiseptic.

5. *Cholera department.*—This department was located on Calle Herran, in Manila, and known as the Santiago Cholera Hospital till January 1, 1903, when it was transferred to the San Lazaro ground. It now occupies a building near the plague and smallpox wards, but it is to be removed to its new quarters within the walls in about two months.

The cases treated during the past year are as follows:

Month.	Remain- ing last report.	Admit- ted.	Diagnosis not cholera.	Died.	Dis- charged.	Number remain- ing.
September	27	79	5	50	39	12
October	12	29	4	16	18	3
November	3	118	4	80	25	12
December	12	9	2	4	14	1
January	1	4	1	2	1	1
February	1	1		1	1	
March		3		3		
April		19		14		5
May	5	73	1	62	12	3
June	3	8	1	6	3	1
July	1	11	1	9	2	
August		25	2	15	6	2
Total		379	21	262	121	

Of the number treated there was a mortality of 68 per cent, or 262 deaths out of 385 cases treated.

The treatment of this disease has been very variable from time to time. At present I pay especial attention to four points: First, not to overstimulate, but constant, gradual stimulation with brandy and strychnine; second, wash out the bowels as high up as possible each four to six hours; third, supply abundant fluid to the system by normal salt enemata each four hours, usually giving a pint at a time; fourth, watch close for suppression of urine and counteract same early by diuretics.

6. *The morgue and crematory.*—A new and elegantly equipped morgue has just been completed. Here we care for all the city dead, where either infectious diseases or crime are suspected.

During the past year 1,044 bodies have passed through the morgue. Of these the following nationalities were represented: Natives, 852; Chinese, 145; Americans, 25; Spaniards, 8; others, 14. The causes of death were as follows: Leprosy, 5; bubonic plague, 179; smallpox, 15; cholera, 749; other causes, 96.

From September 1, 1902, to March 1, 1903, the records do not show the number of autopsies held. Since March 1, 1903, to August 31, 1903, 177 autopsies were held on cases of doubtful diagnosis to confirm or determine the same.

During the year 390 bodies were cremated.

7. *The detention camp.*—This formerly occupied six large nipa buildings 191 by 27 feet in size, each divided into 26 rooms and situated in the south side of the inclosure. During the year it was practically only used between the dates of January 1 and May 19. On the latter date it was entirely consumed by the great Santa Cruz fire, which extended over the walls and consumed this entire group of buildings.

Below will be found a tabulated statement of the contacts admitted during the period from January 1 to May 19, 1903:

Disease.	Admitted.	Discharged.	Transferred with plague.	Transferred with smallpox.	Died of dysentery.	Died in the camp of plague.
Bubonic plague.....	374	365	8	.....	.....	1
Smallpox.....	302	293	.....	8	1	.....

Of the nine plague contacts who developed this disease, they had been in detention, respectively, 7, 13, 2, 8, 2, 4, 2, 3, and 4 days before the disease was recognized.

Of the eight smallpox contacts who developed this disease, they had been in detention, respectively, 14, 12, 12, 1, 1, 5, 10, and 6 days.

Very respectfully submitted.

H. B. WILKINSON,
Physician in Charge.

The COMMISSIONER OF PUBLIC HEALTH,
Manila, P. I.

Circular 4.]

SAN LAZARO HOSPITAL,
Manila, P. I., April 25, 1903.

Rules for governing the reception, care of, and discharge of contacts in the detention department, San Lazaro Hospital.

RECEPTION OF CONTACTS.

1. On entrance all contacts shall be enrolled as usual.
2. They shall be immediately thereafter taken to the bathroom, undressed, bathed, and given a suit of hospital clothing (pajamas or shirt), and all of their personal effects placed in bags and labeled with their admission number.
3. After bathing and putting on hospital clothing, they shall be given bedding and assigned to quarters to await the return of their clothing.
4. The clothing and effects shall be divided into two parts, the first, including all articles not injured by heat, and the second, including only such articles as would be injured by steam sterilization, each part put into bags, taking care to have the bags only loosely filled, labeled as above, sterilized as soon as practicable, and immediately returned to the owners.
5. The first part, as above described, shall be passed through the steam sterilizer, in each case remaining under the steam pressure for one hour.
6. The second part shall be sterilized by formic-aldehyde gas, remaining twelve hours in the closed chamber.

Cases of plague or smallpox occurring among the contacts:

1. The case shall be at once sent to its proper department, accompanied by transfer slip. Also an "individual history slip" made in duplicate, its contents at once telephoned to the central office of the board of health and the original sent in with the next morning report. The duplicate to be retained on file in the detention department, and to it shall be added all information regarding the history of the case, such as the time spent in detention, the probable source of infection, especially the last possible time at which infection could have taken place, etc.
2. The newly made contacts shall be treated in every way exactly the same as if they were new admissions, clothes, bedding, etc., disinfected, the individuals bathed, their former quarters disinfected and new quarters assigned, and their period of detention started over.

THE DISCHARGE OF CONTACTS.

1. The period of detention begins at the time the contacts have been bathed and separated from their clothing and effects, and lasts for nine days in case of plague and fifteen days in case of smallpox.

2. When contacts are discharged their quarters shall be carefully disinfected and left vacant as long as practicable. It will not be necessary to bathe the individuals or disinfect their belongings at the time of discharge.

H. B. WILKINSON,
Physician in Charge.

**REPORT OF THE LEPER HOSPITAL AT CEBU, CEBU, FROM SEPTEMBER 1, 1902,
TO SEPTEMBER 1, 1903.**

OFFICE OF THE BOARD OF HEALTH OF THE PROVINCE OF CEBU, P. I.,
Cebu, P. I., September 3, 1903.

SIR: In compliance with your request of July 6, 1903, I have the honor to submit the following report covering the operation of the leper hospital at Cebu for the twelve months ending September 1, 1903, viz:

Expenses.	Mexican.	Gold.
Clothing.....	\$420.00	
Subsistence of patients.....		\$7,126.40
Medical supplies furnished by insular government, 4 bottles of rum bought for the cholera patients in leper hospital.....	10.00	
Firewood for past eight months.....	194.00	
For repairs to hospital, wages paid to laborers.....	171.00	
Salaries paid attendants, 4 servants for past eight months.....		157.33
Total.....	795.00	7,288.73

Number of patients in hospital September 1, 1902..... 185
From September, 1902, to September 1, 1903:

Number admitted..... 69
Number recaptured..... 2

Total..... 256

Number died..... 53

Number escaped..... 4

Total..... 57

September 1, 1903:

Number patients in hospital..... 199

Number lepers at large in province (approximately)..... 800

Total (approximately)..... 999

Present hospital should be enlarged to accommodate from 800 to 1,000 patients.

Very respectfully,

J. W. SMITH,
President Board of Health, Province of Cebu.

The COMMISSIONER OF HEALTH,
Manila.

**REPORT OF LEPER HOSPITAL, PALESTINA, AMBOS CAMARINES, BY DR. JULIO
TUASON, PHYSICIAN IN CHARGE.**

LEPER HOSPITAL,
Palestina, Ambos Camarines, P. I., August 31, 1903.

SIR: In response to your letter of instructions dated July 6, 1903, promulgating a request from the honorable secretary of the interior, asking for a report covering the operation of the Leper Hospital at Palestina during the twelve-month period prior to September 1, 1903, I have the honor to submit the following information in compliance therewith:

The Leper Hospital at Palestina is located in the province of Ambos Camarines, 4 miles southeast of Nueva Caceres on the Iriga road, in a little barrio called Palestina.

The hospital was built many years ago by the church and Spanish Government as a domicile for natives afflicted with the malady of leprosy, living in and in the vicinity of the province of Ambos Camarines.

The building is a large one, made of native wood and stone, and having a galvanized-iron roof. The hospital is surrounded by a stone wall, which follows the boundary of nearly half a dozen acres of ground belonging to the institution. The ground is rich, level, and low, and could be made very productive, providing there were beasts of burden and men available to cultivate it. Men can not be hired, because there are no funds at hand to employ them and the lepers, are, of course, unable to do heavy labor. The hospital formerly possessed a goodly herd of carabao, but these all succumbed in the past epidemic of surra, reducing the means of transportation to a mere nothing.

The hospital building consists of two wards, one assigned to female and the other to male patients: the attendants apartments are four airy rooms. Attached to the hospital is a small stone chapel, in which the inmates are permitted to worship at will.

The following is a roster of the employees of the hospital, showing number, name, occupation, and pay per month:

No.	Name.	Occupation.	United States currency.
1	Julio Tuason	Physician	\$37. 50
2	Augustus Jacumin	Clerk	10. 00
3	Nicolas Tobal	Cook	10. 00
4	Antonio Balmeo	Assistant cook	7. 50
5	Francisco Punon	Servant	5. 00
6	Gregorio Luyon .....	.....do	5. 00
	Total .....	.....	75. 00

The number of inmates during the twelve-month period, dating from September 1, 1902, to September 1, 1903, was 33; deaths during the period, 5; admitted, 4.

The allowance for the subsistence of the inmates is 10 cents gold per day, which in my opinion is entirely inadequate for the purpose for which allotted. Lepers can not subsist to advantage upon hard, substantial, and solid food. They must have light, nourishing delicacies, such as invigorating soups and vegetables, and these articles, especially in the Philippines, can not be purchased for anything like the amount appropriated for each patient.

In this connection I respectfully request legislation or other action that will cause this subsistence appropriation to be increased to at least 25 cents, United States currency, per day each.

Another thing severely detrimental to the health of the lepers is the unserviceable condition of the building, which is badly out of repair owing to the lack of funds to expend in keeping it in good condition. The building is very old and the floor and roof are badly defective, the former being almost rotted away, while the latter has rusted and leaks freely in many places.

During the period covered by this report the following medicines have been received, to be used in the treatment of lepers:

Medicines received April 20, 1903.

4 kilograms acid, boric, crystals.
 3 liters acid, carbolic, crystals.
 3 liters alboline.
 4 yards belladonnæ emplastrum.
 500 grams iodoform.
 1 kilogram quinine.
 1 liter castor oil.
 1 liter tinctura iodii.
 1 liter acidum nitrum.
 2 pounds camphor crystals.

These supplies are being judiciously expended.
 Respectfully submitted.

JULIO TUASON,
Physician in Charge, Palestina Leper Hospital.

The COMMISSIONER OF PUBLIC HEALTH,
Manila, P. I.

REPORT OF MEDICAL SUPERINTENDENT, CHINESE HOSPITAL FOR CONTAGIOUS DISEASES.

CHINESE HOSPITAL FOR CONTAGIOUS DISEASES,
Manila, P. I., September 1, 1903.

SIR: In compliance with your letter of July 6, 1903, I have the honor to make the following report of the work done in this hospital during the twelve months ending August 31, 1903.

Plague hospital.—From September 1, 1902, to date, 48 cases of bubonic plague have been admitted; of these, 44 cases died, 4 cases recovered, and 3 cases have been discharged with diagnosis "not bubonic plague."

Almost all the cases of plague in this hospital were treated by the Chinese practicante in charge of the hospital with Chinese medicine. I have had only two occasions to try the antipestic inoculation and have succeeded in curing one of the two cases. The other case was sent to the hospital too late and died within two hours after admission into the hospital. The cases treated by me with the antipestic serum are so few that I am unable to draw any definite conclusion as to the effect of this treatment, but still I believe the serum has done good.

The plague patients were formerly placed in an old nipa hospital built four years ago, and it was not until last April that the present very satisfactory building was constructed. Large sums of money were subscribed for this purpose by the Chinese residents, and the present structure is due to their generosity and the kind assistance of Capt. E. L. Munson, who voluntarily gave his personal supervision to the work. This hospital is a permanent wooden structure, 72 by 32 feet, having all the arrangements of a modern hospital and accommodates from 18 to 24 patients. It cost the Chinese Chamber of Commerce \$9,000 Mexican for the construction.

Cholera hospital.—This hospital was built last year and has accommodations for 16 patients. During the last twelve months 42 cases have been admitted with 32 deaths and 4 cured, or a mortality of 90½ per cent. This result is really very poor, and it is attributed to the fact that the patients refused the modern western treatment and were treated by the Chinese practicante according to all the superstitious methods of ancient Chinese medicine.

Smallpox hospital.—There is no building for this purpose, as smallpox seems to be comparatively rare among the Chinese residents. During the last twelve months only 1 case has been admitted and it was placed in the old nipa hospital formerly used for plague cases. This case was discharged cured.

Hospital staff.—The hospital staff consists of 1 nonqualified Chinese practicante appointed by the Chinese Chamber of Commerce, 1 chief wardmaster, 4 hospital attendants, and 1 cook. It costs the Chinese Chamber of Commerce about \$5,000 Mexican for conducting these hospitals.

In conclusion, I beg to say that although the buildings are good modern hospital buildings, the staff is not as yet efficient and the hospitals are not equipped with modern requirements, and I strongly hope that before long the authorities of the Chinese Chamber of Commerce will, for the good of their countrymen, see their way to place the hospitals under modern management.

I have the honor to be, yours, respectfully,

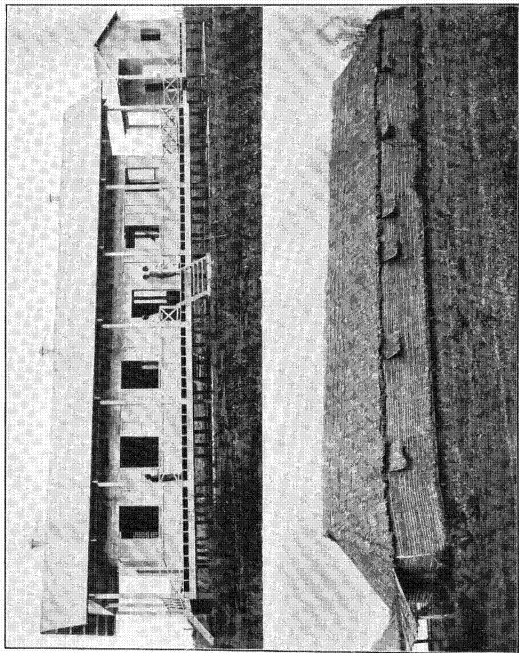
TEE HAN KEE, L. M. S.,
Superintendent, Municipal Physician for Chinese.

THE COMMISSIONER OF PUBLIC HEALTH,
Manila, P. I.

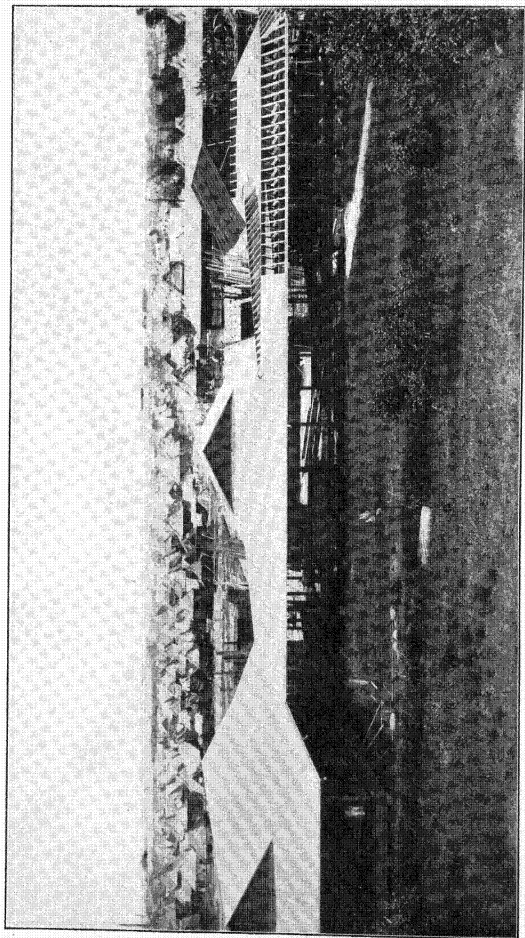
Total number of bubonic-plague cases admitted into the Chinese hospital from September 1, 1902, to August 31, 1903.

Months.	Admitted.	Deaths.	Discharged.
1902.			
November	1	1	.....
1903.			
February	3	3	.....
March	11	9	2
April	22	20	2
May	8	8	.....
June	2	2	.....
August	1	1	.....
Total	48	44	4

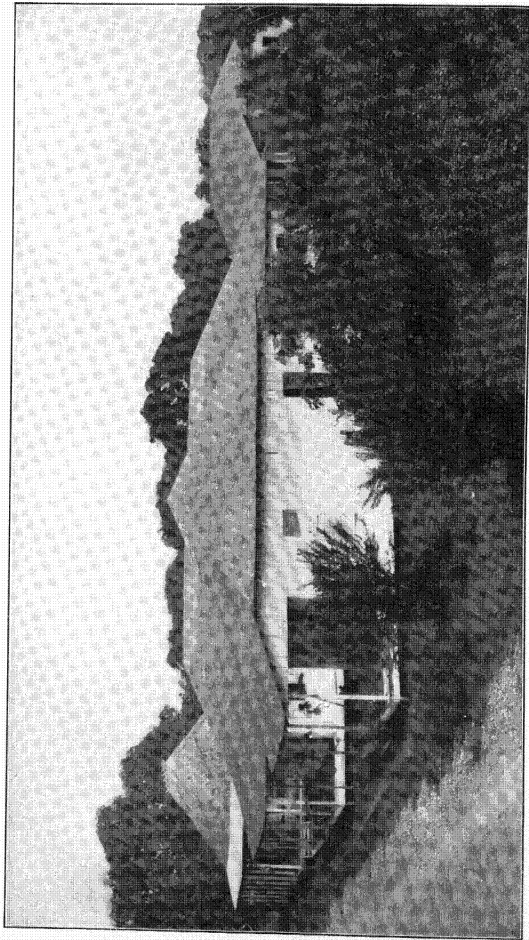
Mortality, 92½ per cent.



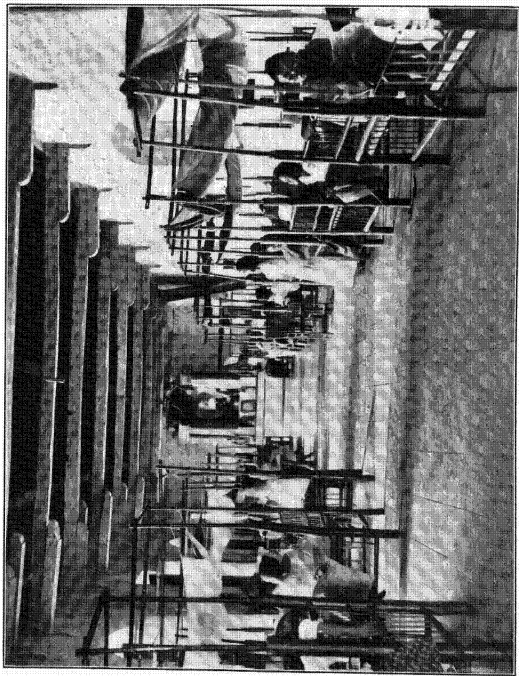
NEW AND OLD CHINESE PLAGUE HOSPITAL WARDS.



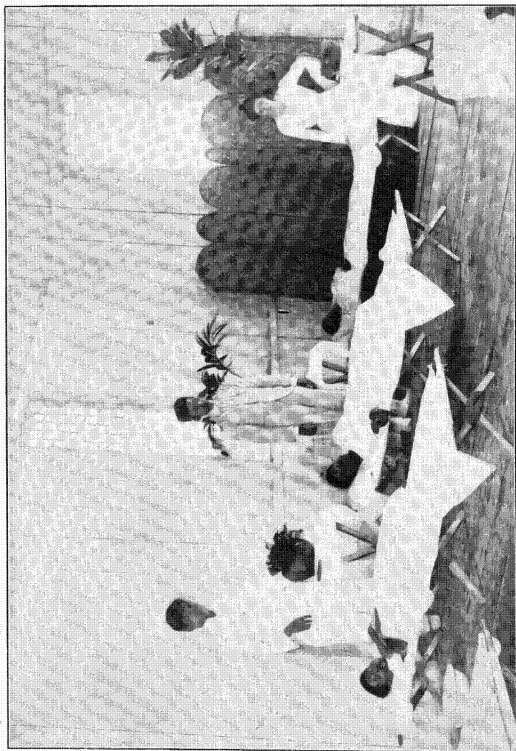
NEW CONTAGIOUS-DISEASE HOSPITAL UNDER CONSTRUCTION, SAN LAZARO.



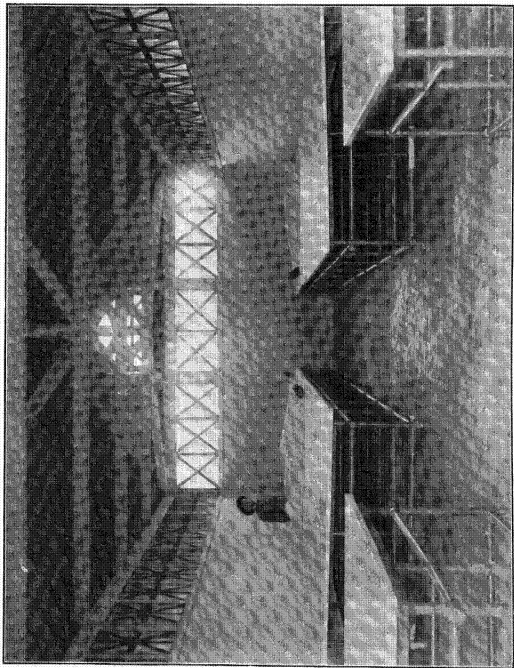
OLD CONTAGIOUS-DISEASE HOSPITAL FOR CHOLERA, PLAGUE, AND SMALLPOX, SAN LAZARO.



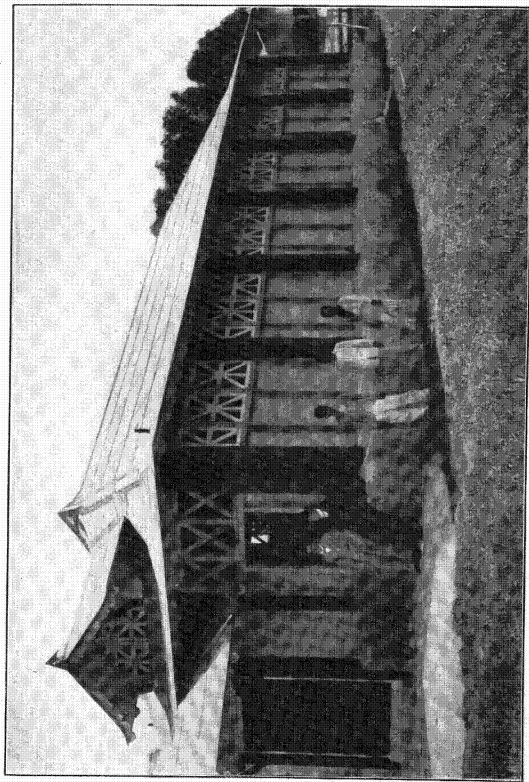
WOMEN'S WARD, LEPER HOSPITAL, SAN LAZARO.



CHOLERA CASES IN NATIVE CHOLERA WARD, SAN LAZARO.



NEW MORGUE, SAN LAZARO.



EXTERIOR OF NEW MORGUE, SAN LAZARO.

Total number of cholera cases admitted into the Chinese hospital from September 1, 1902, to August 31, 1903.

Month.	Admitted.	Deaths.	Discharged.	Month.	Admitted.	Deaths.	Discharged.
1902.				1903.			
September.....	17	15	2	May.....	3	3	.....
October.....	4	4	.....	June.....	1	1	.....
November.....	11	11	.....	July.....	1	1	.....
				August.....	1	.....	1
1903.				Total.....	42	38	4
January.....	2	1	1				
April.....	2	2	.....			

Mortality, 90½ per cent.

REPORT OF THE SURGEON, BILIBID PRISON.

OFFICE OF THE WARDEN OF BILIBID PRISON,
Manila, P. I., September 4, 1903.

SIR: I have the honor to forward to you a report covering the twelve-months period prior to September 1, 1903.

(1) Total number of prisoners incarcerated during the twelve-months period: Males, 5,290; females, 352.

(2) Average daily number of prisoners in confinement, 2,152.

(3) Total number of prisoners admitted to sick report: Males, 2,961; females, 25.

(4) Average daily number of prisoners admitted to sick report: Males, 8.05; females, 0.12.

(5) Average duration of sickness per patient, 11 days.

(6) Total number of deaths, 213.

(7) Average duration of period of imprisonment served by convicts dying during three-months period: (a) Natives—male, 1 year 6 months 13 days; female, 3 years and 2 months. (b) Americans—none; (c) Chinese, 6 months and 25 days.

(8) Average term of imprisonment: Males, 12 years; females, 8 months.

9. Average term of imprisonment to which the deceased convicts had been sentenced: Males, eleven years; females, twelve years.

10. Causes of admission to sick report and deaths:

Diseases.	Filipino.		Male Chinese.	Male American.	Deaths.
	Male.	Female.			
Abscess:					
(a) Inguinal.....	1	.....	.....	.....	.....
(b) Ischioresal.....	10	.....	.....	.....	.....
(c) Liver.....	3	.....	.....	.....	.....
(d) Submaxillary.....	6	.....	.....	.....	.....
Asthma.....	8	.....	.....	.....	.....
Anemia, anchylostomiasis.....	2	.....	.....	.....	.....
Ascites, cirrhosis of liver.....	1	.....	.....	.....	.....
Beriberi.....	1,692	10	.....	.....	107
Bronchitis, acute.....	43	.....	.....	6	.....
Burns, hand.....	1	.....	.....	.....	.....
Conjunctivitis.....	26	.....	.....	.....	.....
Cholera asiatica.....	17	.....	2	.....	12
Carcinoma, testical.....	1	.....	.....	.....	.....
Cystitis.....	1	.....	.....	.....	.....
Cellulitis:					
(a) Leg.....	15	.....	.....	1	.....
(b) Hand.....	2	.....	.....	2	.....
Choleciythiasis.....	1	.....	.....	.....	1
Carbuncle, back.....	2	.....	.....	.....	.....
Cystoma, axilla.....	1	.....	.....	.....	.....
Dengue fever.....	1	.....	.....	.....	.....
Dysentery:					
(a) Amoebic.....	152	.....	.....	.....	17
(b) Catarrhal.....	50	.....	.....	3	.....
Dhobie itch.....	1	.....	.....	.....	.....
Dementia.....	23	.....	.....	.....	.....
Dermatitis:					
(a) Purulent.....	1	.....	.....	.....	.....
(b) Tubercular.....	1	.....	.....	.....	.....
Fecal infection.....	4	.....	.....	.....	.....

Diseases.	Filipino.		Male Chinese.	Male American.	Deaths.
	Male.	Female.			
Fibroma, leg	2	1			
Furunculosis	1				
Fracture, bones of foot	1				
Fistula:					
(a) In ano	14				
(b) Urethral	3				
Epilepsy	1				
Enteritis, acute catarrhal	120				
Entero-colitis	26				
Emphysema, pulmonary	1				
Endocarditis:					
(a) Acute	1				1
(b) Chronic	5				4
Epididymoochitis	3				
Gangrene, pulmonary	1				1
Gonorrhea, chronic	14				
Gastro-enteritis	1				
Hemorrhoids, internal	2				
Gastritis, chronic	14				
Hydrocele, tunica vaginalis	8				
Hernia, inguinal	11				a 1
Intestinal obstruction	1				
Intestinal colic	2				
Intestinal indigestion	6				
Lumbago	3				
Lipoma, ghiteal region	1				
Myelitis, transverse	1				
Mania, acute	8				
Melancholia	5				
Malaria:					
(a) Intermittent	293				
(b) Continued	46	1			6
Morphinism	1				
Megrairie		1			
Nephritis:					
(a) Acute	2				
(b) Chronic	12				9
Ophthalmia, purulent	2				
Osteo sarcoma, inferior maxillary	1				
Orchitis	4				
Pregnancy, delivered		5			
Pneumonia	35				28
Peritonitis	1				1
Plague:					
(a) Bubonic	1				
(b) Pneumonic	15				2
Pleuritis	7				
Phimosis, chancroidal	3				
Prostatitis, acute	1				
Prolapsus recti	1				
Parotitis	16				
Rheumatism, acute, articular	21				1
Rupture, small ligaments, foot	1				
Retention of urine	1				
Spinal meningal congestion	1				
Senile debility	4				3
Sciatica			1		
Sebaceous cyst, face	1				
Sarcoma, lower jaw	1				
Smallpox	1				
Tonsillitis			1		
Torticollis	1				
Syphilis, secondary	5				
Septicæmia	1				1
Stomatitis	2		2		
Synovitis, knee	1				
Tuberculosis:					
(a) Pulmonary	38				24
(b) Facial lupus	1				
Ulcer:					
(a) Varicose	2		1		
(b) Traumatic	2				
(c) Tropic	1				
Uremia	2				
Varicose veins, leg			1		
Varicella	20				
Wounds:					
(a) Incised, hand, arms	4				
(b) Lacerated scalp	4				
(c) Contused, head, body	10				
(d) Gunshot, arm, body	6				
(e) Infected, hand, feet	6				
Total deaths					213

a Strangulated.

11. No cases of insanity developed among the convicts.

12. The following are the more important diseases occurring among the prisoners incarcerated here:

- (a) Amoebic dysentery.
- (b) Beriberi.
- (c) Cholera asiatica.
- (d) Malarial fever.
- (e) Plague, bubonic and pneumonic.
- (f) Pneumonia.
- (g) Tuberculosis.

(a) Amoebic dysentery has presented itself only in the subacute and chronic form, the prisoners having these previous to their admission to the prison. The usual precautions as to the disposal of excreta in strong solutions of crude carbolic acid and chloride of lime, and in the disinfection of bedding by steam, and a strict antiseptic toilet of the nurses' hands are carried out. The treatment of these cases has been absolute rest in bed; a nutritious liquid diet, consisting of milk and raw eggs and broths of chicken and beef; the administration of gram doses of bismuth, subnitrate, and subgallate, combined with a centigram of calomel every two hours, and the irrigation of the colon with hot quinine solution of a strength of 1 to 400 every three hours.

(b) Since 1892 all of the cases of beriberi occurring in this institution have been contracted previous to admission. These cases improve rapidly upon the prison ration and tonics of iron, arsenic, and strychnine. All cases of beriberi are treated in a special ward.

(c) During the first week of August there occurred 10 cases of cholera among the prisoners, the epidemic starting without warning and without any departure from the usual routine precautions in regard to the food and drink. An immediate investigation showed that the only article of diet furnished the prisoners without first being cooked was a small dried fish caught in Manila Bay. Upon the prohibition of this food the epidemic immediately subsided. The cases were immediately isolated and the various brigades from which the cases had been taken were thoroughly disinfected and quarantined. The treatment consisted of copious hyperdermoclysis of normal salt solution, replaced by intravenous injection of the same solution from time to time; copious irrigation of the colon with hot saline solutions every second hour; administration of double capsules containing 50 centigrams of silver nitrate every two hours; hypodermic use of strychnia, nitroglycerin and whisky, and the use of continuous hot pack. The mortality was 80 per cent.

(d) Malarial fever occurred principally in the tertian form, although the remittent or estivo-autumnal variety is not uncommon. The disease is apparently present in a great majority of the cases upon admission to the prison, although there is small room to doubt the occurrence of infection from mosquitoes here in this institution, as, owing to the close proximity of esteros and stagnant rain water pools, the mosquitoes swarm in large numbers in this vicinity. As yet the screening of the brigades has been found impracticable, although efforts toward that desired end are being made as rapidly as possible. The treatment is systematic administration of quinine, arsenic, and iron, supplemented by the use of ergot when there is an enlargement of the spleen, in order to cause the expulsion of all parasites into the general circulation, where they can be more readily acted upon by the quinine.

(e) During the latter part of June and the first part of July there occurred among the prisoners 15 cases of pulmonary plague with 2 deaths and 13 recoveries. The cases all occurred among bamboo workers who were constantly exposed to the fine dust resulting from the manufacture of bamboo furniture. Upon investigation it was found that the bamboo was hauled to the prison directly from the esteros where it was taken out at low tide covered with filth from the muddy bottom. Despite the fact that the epidemic ceased upon the thorough cleansing and disinfection of the bamboo, no plague bacilli were found in the cultures from the bamboo and from the estero mud. Yet, in view of the clinical fact that both this epidemic and that from cholera ceased upon the removal of the only apparent possible source of infection, and in spite of the negative bacteriological findings, the writer feels justified in attributing these much-dreaded diseases to the suggested sources. As these cases arose they were immediately isolated and the brigades from which they came were thoroughly disinfected and quarantined, and the contact inoculated with curative antipest serum.

These cases all presented the pneumonic type of the disease, being characterized by massive consolidation of the lungs, intense dyspnoea, toxemia, and profound weakness of the heart. Microscopical examinations of the sputum from these cases show the presence of a bacillus identical morphologically with plague bacillus in almost pure cultures. The treatment consisted in the administration of 20 centimeters of plague antitoxin every hour until the temperature dropped, as it did in most cases

from 106° F. to 96° F. in from six to twelve hours; the patient coming out from the intense discomfort of hyperpyrexia and dyspnoea into a state of comparative ease and comfort. In addition to the antitoxin, the patients emunctories were thoroughly stimulated by calomel and copious administrations of normal salt solution. In most cases the heart action was supported by the use of strychnine, nitroglycerin, digitalis, and in some cases alcohol. A feature worthy of note in these cases was the almost immediate pulmonary consolidation occurring in most of the cases from two to six hours after the onset of the disease. In all the cases both lungs were generally affected, so much so that it seemed as though there was scarcely enough functioning issue to support vital combustion. After the subsidence of the fever and dyspnoea patients entered into a tedious convalescence, regaining lung function and strength with marked slowness.

(f) Pneumonia, more commonly of the diffused lobular variety, occurs with persistent regularity among the prisoners, more especially during the rainy season, as then chances for sudden lowering of bodily temperature are present. All cases of pneumonia are isolated and the sputum disinfected as in tuberculosis. The treatment has been that usually pursued in hospital work: Ice-cold packs to the chest, free catharsis, forced drinking of large quantities of normal salt solution, stimulation when required by strychnine, nitroglycerin, and whisky, and the persistent application to the entire chest of a 5 per cent solution of guaiacol in vaseline. The writer feels justified in laying stress upon this last procedure as both patients and physician are quickly aware of its marked benefit and efficacy.

(g) Tuberculosis exists among the native prisoners to an alarming extent, many of them being in the last stages of the disease upon admission to the prison. Owing to the strict quarantine and special ward treatment of these cases there has been no spread of the disease in the institution. The treatment consists of judicious lung exercise in the cool of the morning and evening, highly nutritious diet of milk, eggs, and animal broth, with rice, vegetables, and wheat bread; the use of such tonics as strychnia, iron, and arsenic; the administration of an emulsion containing 5 drops of pure guaiacol every three hours; the application to the entire chest of a 5 per cent ointment of the same drug, and the administration of small doses of 3 milligrams of heroin every four hours as occasions demand.

13. Despite the fact of the low level of the ground upon which the prison is built, being only from 40 to 80 centimeters above high-water mark, the general sanitary condition, owing to the improved cement drains, efficient disposal of excreta, and the construction of efficiently ventilated brigade buildings, is far better than could be expected. At present the excreta is carried off from the latrines by modern plumbing into large cement vaults outside of the prison walls where it is removed daily by odorless excavators. As this system is open to the objection of a possible disablement of the excavators and a consequent embarrassment of the latrines, a modern system of septic tank treatment is about to be installed outside of the walls, thus making the institution entirely independent and free from the possibility of accident.

The brigade buildings are constructed so that the floor is about 60 centimeters higher than the yard floor, and are fitted with large, wide windows, continuously open, and at intervals of 4 feet around the buildings. In the center of the ceilings there are large hood ventilators, which, with the free influx of air from the sides, makes such a constant change of air that it permits of what in an otherwise constructed building would be a very grievous overcrowding. All sentenced prisoners are compelled under the regulations to work seven and one-half hours each day, exclusive of Sundays and legal holidays, thus insuring sufficient exercise for them. Prisoners in close confinement are allowed the use of a section of the yard for exercise in the morning and evening. Detention prisoners, held awaiting trial or the result of their appeal before the supreme court, have the freedom of a large section of the yard during the day for their exercise. They may, however, be placed at work should they so signify their desires to the assistant wardens or warden.

All the rain water and water from bathrooms, wash rooms, etc., is carried by means of improved cement drains to a place just outside of the prison walls to be there emptied into an estero.

All water used at this prison is from the water supply of the city of Manila, but is boiled at this prison before using.

The offal from the kitchens, and all other waste, is removed in iron cans daily, being disposed of at the city crematory.

Copy of list of rations furnished to the native and American prisoners attached.

Very respectfully,

WM. R. MOULDEN,
Acting Resident Physician, Bilibid Prison.

THE COMMISSIONER OF PUBLIC HEALTH,
Manila, P. I.

NATIVE RATION.

Proportionate quantities issued per man: Canned corned beef, $\frac{1}{3}$ pound; beef, fresh, $\frac{1}{2}$ pound, or bacon, 4 ounces, or canned roast beef, $\frac{1}{3}$ pound, or salmon, $\frac{1}{2}$ pound, or codfish, $\frac{1}{3}$ pound, or fresh fish, $\frac{1}{2}$ pound; flour, 1 pound, or hard bread, 1 pound, or rice, $1\frac{1}{2}$ pounds; potatoes, 3 ounces, or onions, 1 ounce; sugar, $\frac{1}{15}$ pound; vinegar, $\frac{1}{12}$ gill; salt, $\frac{1}{25}$ pound; pepper, $\frac{1}{50}$ ounce; soap, $\frac{3}{25}$ ounce.

From the savings authorized by this order are purchased ginger root, dried fish, small camotes, tomatoes (canned), and pork (fresh), to give variety to the dietary. Cost of ration, 10 cents.

AMERICAN RATION.

Proportionate amounts issued per man: Eggs, 2 each; coffee (green), 1.08 ounces; bread, 1.5 pounds; salt, 1 ounce; sugar, 2.3 ounces; pepper, 0.012 ounce; beef or mutton, 0.52 pound; potatoes, 0.72 pound; tomatoes, 1.6 ounces; onions, 2.5 ounces, or beans, 0.48 pound; bacon, 2.5 ounces, or beans, 0.48 pound; pork, fresh, 4.5 ounces; corned beef, 4 ounces; potatoes and onions, 0.64 pound, or codfish, 3.2 ounces; potatoes and onions, 0.64 pound, or fresh beef, 5.10 ounces; potatoes and onions, 0.64 pound; squash, 11.5 ounces.

Rice pudding or bread pudding has been issued occasionally, and when in commissary sauerkraut, $2\frac{1}{2}$ gills per man, and camotes, 9 ounces per man, these articles being issued for the last meal of the day; and also squash pie, evaporated cream in cans, and sugar being issued extra for those articles that require sweetening; and corned beef, 3 ounces per man, is issued with sauerkraut.

SPECIAL REPORT ON BUBONIC PLAGUE, BY DR. E. L. MUNSON, ASSISTANT TO THE COMMISSIONER OF PUBLIC HEALTH.

Since the appearance of the first recognized case of bubonic plague in Manila, from January 1, 1900, to September 1, 1903, there have occurred 970 cases of this disease, with 812 deaths, giving a total case mortality of 83.8 per cent for the outbreaks occurring in the four successive years. Of the above totals 198 cases, with 166 deaths, have occurred during the twelve months prior to September 1, 1903, giving a general case mortality for this period also of 83.8 per cent. This case mortality is less than that in Hongkong, in which place the rate during the past year has been 87.6 per cent.

The city of Manila appears to be the only place in the islands in which plague has gained a foothold. It is true that a few cases have developed outside of Manila, but so far as known, with but one exception, all the persons so affected had lately been in the city and had presumably acquired their infection there. There seems to have been no spread of the disease from these persons to those with whom they came into contact. During the four years 34 cases of plague, with 27 deaths—and in the past year 3 cases, with 3 deaths—have occurred in transients while on a visit to Manila, nearly all of these persons being from small towns in the vicinity. That the disease has not been widely transported to other points in the islands by plague rats is due to the fact that cascos, bancas, and lorchas afford no secure retreat in which rats can hide, and small interisland steamers tying in the river here are nearly always required to take on and discharge cargo at other ports by means of open lighters, while lying well offshore. It is difficult for rats to spread the disease from Manila by land, as the opportunity for their transportation by rail or vehicle is practically nil, and the numerous canals in and around Manila, together with the fact that the city is practically surrounded by lowlands and rice fields which are flooded during a large part of the year, offer few opportunities for the natural migration of rodents. For these reasons, if the interisland boats are occasionally fumigated to kill the rats thereon, it would seem as if there should be little likelihood of other parts of the islands becoming infected. If the steamers from China and plague-infected ports are watched, kept out in the bay unless fumigated, and their Chinese passengers subjected to preventive inoculation there is no reason why in the future new infections should be introduced into the city from the Asian mainland, as has undoubtedly been the case from time to time in the past. If, then, there remains but a single infected point in the islands which can be kept from receiving new infections from outside it should be possible to ultimately exterminate the plague infection by the use of necessarily comprehensive sanitary measures, the expenditure of sufficient funds, and by the exercise of much discretion and patience. This, however, is not to be regarded as a simple matter. Plague infection is extremely insidious and sporadic cases develop every now and then in communities from which it had been thought that the disease had been exterminated. This tend-

ency on the part of plague has frequently led to premature belief that its infection had been eradicated, as was the case in 1902 in the city of Manila, Yokohama, Japan, Honolulu, Hawaii, and in various cities of Australia, where as a matter of fact the infection had simply been so reduced and controlled that its active existence had been converted into a condition of latency. For this reason it is important to remember that while proper measures exert a prompt effect upon the prevalence of the disease it will not do to relax the precautions needful merely because the disease is greatly diminished as to the number of cases, or even if a case has not developed for six months. A proper time test of the eradication of the existing plague infection from the city of Manila should be regarded as twelve consecutive months during which period not a case of the disease has occurred among human beings nor a plague-infected rat found. No less an authority than the Surgeon-General of the Marine-Hospital Service is reported to have recently stated that a city once infected with plague could not be pronounced free from the disease until after the expiration of three years during which a plague case had not occurred. This minimum time limit set by him would seem to be unnecessarily high, but it shows the attitude of many of the best authorities as to the importance of continuing the measures of plague prevention long after the need for their application has apparently ceased to exist.

The cases of plague occurring in Manila from January 1, 1900, to September 1, 1903, have been distributed through the city by districts as follows:

City district.	Total population of district, census of 1903.	Chinese population of district, census of 1903.	Plague cases in district.	Plague cases per 1,000 population.
San Nicolas	29,059	7,225	312	10.73
Binondo	16,613	6,386	239	13.79
Tondo	37,889	934	140	3.69
Santa Cruz	35,040	3,690	88	2.51
Intramuros	11,463	559	74	6.45
Quiapo	11,149	290	47	4.22
San Miguel	8,838	693	10	1.13
Sampaloc	18,779	347	11	.59
Malate	8,858	122	4	.45
Paco	6,725	151	5	.74
Ermita	12,226	631	3	.25
Pandacan	2,990	48	3	1.
Santa Ana	3,255	27	-----	-----

From the above figures it is evident that plague has been very closely restricted to certain quarters of the city, and chiefly to those quarters in which the Chinese population is relatively large. The districts which have been especially infected are also those in which the poorer and less intelligent classes live and where there is the greatest degree of overcrowding, both of buildings with respect to each other and of persons within them. The disease has especially prevailed along the water front and in the congested mercantile districts, where it evidently secured its first foothold. The buildings of these districts are largely of old Spanish construction, poorly ventilated, insufficiently lighted, and generally unsanitary. They afford innumerable retreats and runs for rats, from which these can not be readily dislodged, and when once infected with plague the disinfection of these buildings becomes a matter of very great difficulty. As a rule it is in the most unsanitary houses that the plague cases occur.

During the twelve months prior to September 1, 1903, the cases of plague were distributed throughout the city, by districts, as follows:

City district.	Number of cases.	City district.	Number of cases.
San Nicolas	50	San Miguel	5
Binondo	42	Ermita	3
Tondo	28	Sampaloc	3
Santa Cruz	32	Malate	1
Quiapo	22	Pandacan	1
Intramuros	8		

This varies, on the whole, but little from the general distribution of the disease for the entire period of its existence. As previously shown, the plague situation in the walled city has been much improved, while that for Quiapo district has lately become somewhat less satisfactory. Conditions in the remaining districts are practically unchanged. It is possible that all the districts in the city are infected, but if so this is certainly the case with regard to some of them to only a relatively slight

degree. Obviously, the plague infection is practically unable to spread among human beings in certain districts, and seems, indeed, to maintain its very existence with much difficulty in certain parts of the city. With abundant opportunity for transmission of the infection by human beings and migrating plague rats, there is nothing to have prevented these districts from becoming plague centers except certain local conditions and the character, class, and mode of life of the inhabitants. Reasoning from the past, the probability of their becoming seriously infected in the future seems, therefore, not to be great. They may thus practically be disregarded in the application of special preventive measures against plague, with the expectation that if the plague infection can be exterminated by vigorous efforts in such districts as San Nicolas and Binondo it will simultaneously cease to exist in Ermita, Malate, San Miguel, and other sections of the town, as a result of these latter districts no longer being able to acquire new infections from time to time from the districts in which the disease has extensively prevailed. The sanitary work against plague now being carried on and projected for the future is based on the fact that plague in Manila is a disease of restricted locality, from which it is apparently able to extend and perpetuate itself only with considerable difficulty. It would seem the part of wisdom, therefore, to concentrate every energy upon the extermination of plague infection from those districts in which the disease has unquestionably secured a permanent foothold.

Using the census figures for 1903 as a basis of estimation, it is seen that from January 1, 1900, to September 1, 1903, the various classes of the population, not including American soldiers, furnished plague cases in the following proportion, by race:

Race.	Number of persons, census of 1903.	Number of plague cases.	Number of plague cases per 1,000 population.
Americans.....	4,389	6	1.3
Europeans.....	3,645	6	1.6
Chinese.....	21,230	578	27.2
Filipinos.....	189,782	379	2.
All others.....	895	1	1.1
Total.....	219,941	970	4.4

These figures show the great susceptibility of the Chinese population to the disease, it occurring relatively about twelve times more frequently among Chinese than among Filipinos and about twenty times more frequently than among Americans. As far as Manila is concerned, plague may almost be regarded as a Chinese disease. Similar figures are found in every plague-infected town in which a white and Chinese population coexist. In San Francisco it is understood that 92 cases of plague occurred among Chinese, but not a single case appeared among whites. In Hongkong the Chinese population has suffered in respect to the disease to a disproportionately great extent. Any special efforts against the disease must therefore be made to apply first of all to the Chinese.

The case mortality of plague for the total period, January 1, 1900, to September 1, 1903, was influenced by race as follows:

Race.	Number of cases.	Number of deaths.	Case mortality.
Americans.....	6	4	<i>Per cent.</i> 66.6
Europeans.....	6	6	100
Chinese.....	578	513	88.7
Filipinos.....	379	288	75.9
Others.....	1	1	100

These figures show that not only are the Chinese very much more liable to contract plague than are the Americans or Filipinos, but if they do contract it they are much more liable to die from the disease. This experience in Manila is borne out in the epidemics elsewhere, where the relatively slight vital resistance of the Chinese against plague has always been apparent. Thus in Hongkong, during the present year, of 1,279 Chinese attacked 1,183 died, or 92.4 per cent; of 84 other Asiatics, 39, or 46.3 per cent, died; while of 36 Europeans but 4, or 11.1 per cent, succumbed. The difference in racial susceptibility to plague and in vital resistance to the disease, as shown by the above figures, is very striking.

The classification of the plague cases by age can not be carried out except for the twelve months past, as prior to September 1, 1902, no record was kept of the ages of the persons attacked. For the period September 1, 1902, to September 1, 1903, the number of cases occurring in the various periods of life was as follows:

Age by years.	Number of cases.	Number of deaths.	Case mortality.
			<i>Per cent.</i>
Less than 1 year.....			
1 to 5.....	1	1	100
6 to 10.....	6	4	66.6
11 to 15.....	13	10	76.9
16 to 20.....	32	22	68.7
21 to 25.....	24	18	75
26 to 30.....	37	34	91.8
31 to 35.....	18	16	86.6
36 to 40.....	24	20	83.3
41 to 45.....	17	16	94.1
46 to 50.....	8	7	87.5
51 to 55.....	7	7	100
56 to 60.....	6	6	100
61 to 65.....	3	3	100
65 and over.....	1	1	100
Unknown.....	1	1	100

So far as the above statistics go to show, plague would seem to be a disease of early and middle adult life. These figures can scarcely be accepted, however, as representing the true facts in the case, as the disease especially affects the Chinese portion of the Manila population, which largely consists of able-bodied men of the working age, and includes but few Chinese children and old persons, as the latter usually prefer to return to China to spend their last years of life, and relatively few births occur among the persons of this nationality. Proper understanding of the relation of age to the occurrence of the disease should therefore be limited, in the case of Manila, to figures based upon the Filipino class, the data in respect to which are not as yet sufficiently comprehensive to warrant the basing of any conclusions thereon. From the above figures it would appear that the chances of recovery from plague are best in early adult life.

Plague is a disease which, in Manila, is almost exactly six times as liable to occur in males as in females. Thus out of a total of 970 cases 829 occurred in males and 141 in females, while for the past twelve months there have been 160 cases in males and 38 in females. This is to be explained by the fact that the disease is largely confined to the Chinese population, which is almost wholly composed of adult males, there being, according to recent estimates, about 300 Chinese women in the city. On the other hand, relatively more cases occur among women than men among the Filipinos, which is explainable by the fact that the coolies of the lower-class Chinese largely intermarry with Filipino women, who are thus brought into relation with a class peculiarly susceptible to the disease and are placed under conditions as to habitations and surroundings whereby they become much more exposed to the danger of contracting the plague infection than are their sisters living under more sanitary surroundings. Another factor operating for the occurrence of a greater number of cases in men than women is that the lower class Chinese men usually go barefooted, so that plague infection through accidental lesions of the skin is much more liable to occur than among women, even the poorest of whom ordinarily wear some protection for the feet in the form of the loose slipper of the country.

During the entire period of the existence of plague, of the total number of 970 cases occurring 577 were alive and 393 dead when found. For the twelve-months period September 1, 1902, to September 1, 1903, out of 198 cases 107 were alive when reported and 91 were dead. This condition depended upon several factors. The most important of these is due to the common failure on the part of persons of the less-educated classes to call in medical attendance in case of sickness of any character. This is due to ignorance and fatalistic ideas, to dislike of modern medical methods and drugs on the part of both Chinese and Filipinos, and because until recently there was no educated physician in the city who could speak to the Chinese in their own tongue and thus secure their confidence. In probably not a few cases, especially among the Chinese, the nature of the disease was not recognized before death. If it was understood, its existence during life was willfully concealed in many instances for the purpose of avoiding the annoyances and interference with business incident to disinfection and quarantine, but such concealment could not be continued after death, since burial could not be had without a permit. Finally, the disease is acute

in type, particularly the pneumonic form, and the stricken persons may succumb very rapidly to its influence. The fact that such a large proportion of the cases were not found during life has materially hampered the sanitary authorities in the work of stamping out local infections at as early a stage as possible. Lack of cooperation and passive opposition of this sort is a serious obstacle to the attainment of good sanitary results, but it is naturally so difficult of legal proof as to render it practically impossible to secure the conviction of the offenders before the courts.

The only case of plague infection known to have occurred in those looking after plague cases developed in a Filipino morgue attendant at San Lazaro during August, 1903. This man had slightly burned himself with carbolic acid on the outside of his wrist, leaving a raw surface at the time the infection presumably took place. On August 17 it was part of his duty to sew up several bodies dead of plague, upon which autopsies had been performed, and it is easy to understand how, during this task, a sore located on the outer aspect of the wrist might readily have been bathed in plague secretions and thus become infected. The attendant was warned to protect his sore, but it would appear that he did not do so. On August 19 he developed a high temperature, followed by characteristic symptoms of plague, from which disease he died on August 24. An interesting feature of plague in the Philippines would seem to be the apparent disinclination of the disease to spread directly from sick to healthy persons. Infection seems rarely to have occurred in this way, but to have generally proceeded from some outside source, from which, however, several individuals might have become infected at about the same time. Of 374 plague contacts quarantined at the detention camp between January 1 and May 19, 1903, but 9 developed plague, and of those only 3 developed the disease after the fourth day of isolation. With such a small percentage of contacts showing the disease, it was thought that their quarantine might safely be abandoned, and this conclusion was also reached during the outbreaks in Australia and in Honolulu. So far there has been no apparent reason to regret having taken such action in Manila. Plague contacts were at the outset scrupulously quarantined at the detention camp for a period of 9 days. During the absence in quarantine of the proprietor, his residence or store was necessarily closed, or if opened for disinfection and repairs this was under circumstances permitting of theft by the dishonest. Any business affected was closed. As a result there was much complaint by the Chinese and a tendency to evade the sanitary regulations relative to plague, to avoid the great discomfort and financial loss attaching to the finding of a case of this disease. The board of health therefore adopted and put into operation the following procedure in this disease:

As soon as a plague case is located, a special police is at once placed over the house and no one allowed to pass in or out. All contacts are removed to San Lazaro, where they are inoculated with antiplague serum, are bathed, and their persons and clothing disinfected, after which they are released. In the meantime the patient has been removed to the plague hospital, and the house has been gone over thoroughly by the rat catchers of the sanitary district, and every effort made to exterminate these rodents. After the rat catchers have finished, the house and its contents are disinfected and the contacts are allowed to return. Sanitary orders are then served for the repairs to be made on the house, which include making it rat proof, in addition to a general sanitary overhauling. Where houses are in too bad a condition to justify repairs they are closed, condemned, and destroyed. If contacts are allowed to return to the house they may at once resume their business or calling, but are kept under special sanitary oversight during the period of the incubation of plague. By the above plan the interests of the contacts are interfered with as little as possible, and there is little opposition to the antiplague measures taken.

During the year there were 23 houses infected with plague which were declared nuisances by the board of health, and were destroyed by fire after appraisal as to value. These houses were nearly all old and of little value, and were usually unsanitary and in such locations that their destruction for any reason would have been a public benefit. This work of destruction was brought to an abrupt conclusion by the Trozo fire, which rendered so many people homeless that it was thought inadvisable to burn down shelters which, with the onset of the rains, would be urgently needed for the population of an already crowded city. During the past few months, therefore, reliance has been had upon the most careful efforts for the disinfection and repair of such buildings, which were again thrown open for temporary occupancy.

It is proposed now to prepare a list of all houses in the city in which plague cases have occurred or plague rats have been found during the past four years. These houses are then to be carefully inspected, and any repairs necessary to place them in the best sanitary condition will be ordered, and completion of the work required before the end of the present calendar year, when a cyclic increase of plague under

the more favorable meteorological conditions of the dry season might otherwise be expected to occur.

Much has been done in the prevention of plague through the destruction of rats, as there is no question but that these rodents are potent agents in its spread. In fact, so susceptible are they to the disease that perhaps plague should be regarded, like glanders, as primarily a disease of the lower animals, but capable also, under proper circumstances, of transmission to man. During the year 1902, with the great diminution of plague cases and with the energies of the health department concentrated against cholera, the catching of rats, carried on so successfully during the previous year, was discontinued. In February of the present year the recrudescence of plague necessitated the organization of a corps of rat catchers, of whom six were assigned to each sanitary station. In April additional rat catchers were authorized for the specially infected districts, and a public bounty was offered for rats delivered at any sanitary station. As a result there have been 75,639 rats destroyed by the health department in the space of six months. The greater part of these rats were captured in the districts infected with plague most generally. In addition to the ordinary destruction of rats by householders, some 500 traps were loaned to the Chinese Chamber of Commerce for use by the Chinese. This department was, and still is, unable to secure for its purposes a sufficient number of traps, 3,000 of which were ordered through the insular purchasing agent some months ago. Of the 2,500 traps on hand, a large proportion were of the large-wire variety, which experience has shown that rats are relatively disinclined to enter.

In addition to the use of traps, poisoning has been freely practiced, but without apparently obtaining results to compensate for the labor involved. Various sorts of poison and all kinds of baits and combinations have been tried, but without satisfactory results. While elsewhere the use of poison has been very successful in rat destruction, here the number so destroyed has been disappointingly small. Relatively few poisoned baits seem to be disturbed and only a small number of rats so killed are found.

A very successful means of destruction is by the rat catchers exploring likely looking retreats with their hands or sticks, or in the rainy season by pouring water into their underground burrows. Many of the rat catchers catch the escaping rats with their bare hands, without regard for the bites which are sure to be received. An effort has been made to secure ferrets for this work, but so far without success. At one or two stations portable furnaces for driving rats out of their burrows by sulphur fumes have been tried. Out of a total of 75,639 rats captured, 35,191 were caught in traps; 36,956 by rat catchers, with their hands and sticks; 3,072 by poison, and 420 were purchased.

As illustrating the effectiveness of the work of the rat catchers, it may be mentioned that plague was discovered in a rat caught in a large building on Calle Santa Elena on February 9. The rat catchers of the district were at once sent there and caught 70 rats in one day and about 200 were taken from the building and its immediate surroundings during the month.

Rats captured are tagged with the street and number of the house in which caught, and when not decomposed are sent to the laboratory for examination. It is of course impossible, with a limited number of observers and pressure of other work, that the total number of rats caught should be examined post-mortem, and the changes incident to moving the biological laboratory have also interrupted the work. Out of the total number of rats examined up to September 1, 1.69 per cent were found to have plague. The relative proportion of affected rats decreased as the disease subsided among human beings, 2.47 per cent being so affected in the month of February and none during the month of June and subsequently.

The proportion of affected rats captured is not, however, a fair index of the actual prevalence of the disease among the rat population. The plague rat is a sick rat, which naturally seeks seclusion and is not impelled through a vigorous appetite to destruction by trap or poisoned bait. Only those in the early stages of the disease are thus liable to capture by ordinary measures, and rat destruction would seem to be of value not so much through the destruction of existing infection as through the removal of susceptible but as yet unaffected, material by means of which the disease may subsequently be spread. In the present epidemic in Hongkong certain observers claim to have found plague bacilli in a large variety of domestic animals and fowls, and the tendency there has been to regard rats as only one of many agents in the spread of the disease. As far as the epidemic goes in Manila, however, there would seem to be little evidence to corroborate this belief.

By far the most effective measure of prevention against plague has been found in Manila in prophylactic inoculation of the classes especially susceptible to the disease. This was carried out in 1901 with good results, some 25,000 inoculations being made.

Its effect has, however, been particularly noticeable during the present year, when it has been possible to compare the movement of plague in the Chinese, who were largely subjected to inoculation, with that in the Filipino population, in which no prophylactic inoculations were performed. The occurrence of plague in these two classes has been as follows:

Month.	Cases in Filipinos.	Cases in Chinese.	Total cases.
1903.			
January	2	.....	2
February	10	7	17
March	16	25	41
April	15	35	a 52
May	10	16	b 28
June	23	9	32
July	12	2	14
August	10	1	11
Total	98	95	198

a Two cases in Americans.

b Two cases in foreigners.

Near the end of April inoculation of the Chinese against plague was begun by the municipal physician for the Chinese, and on May 11 the general inoculation of this class of the population was ordered and carried out at the various stations of the board of health. Up to the month of June 60.4 per cent of all the plague cases occurring in the city of Manila were furnished by 21,230 Chinese, while 189,782 Filipinos, a population about nine times greater, furnished but 39.6 per cent of cases. As the number of inoculated Chinese increased, a marked diminution of plague cases among them was noted. For the month of June the Chinese furnished but 28.1 per cent of the total cases, for July but 14.4 per cent, and for August but 9 per cent, the Filipinos supplying all the other cases. On June 30 there had been performed 11,135 primary and 3,608 secondary prophylactic inoculations, which meant that slightly over half the Chinese population had been partially immunized and about one-sixth completely protected against plague. As the inoculations were, however, carried out largely in the most infected districts of the city, and as the Chinese living in the most unsanitary houses of these districts were largely those subjected to the operation, the very great reduction of the Chinese plague rate as compared with the total number of this class partially immunized can better be understood. The results of this general inoculation of Chinese were not only striking as respects their racial class, but were particularly well shown in individual instances within that class. Thus it has happened in a number of instances that the only uninoculated individual in a Chinese lodging house has acquired the disease, while his associates, living under identically the same conditions, but who had been inoculated a week or ten days previously, have entirely escaped. Complete protection can only be assured by secondary inoculation, though apparently a primary inoculation alone is not without advantage in this respect. Several instances have occurred, however, in which persons receiving only the primary inoculation have contracted the disease subsequently, but in no case has it happened that the disease has appeared in an individual who had received a secondary prophylactic inoculation. So obvious was the success of the process to the Chinese themselves, that while at first many were disinclined to undergo the procedure, within a month the general feeling had entirely changed in its favor. Inoculation as practiced here has been accompanied by absolutely no untoward results, nor has the local reaction ever been sufficiently severe to cause undue discomfort, never causing as much inconvenience as would be due to vaccination. The weak point of the method consists in the requirement for a secondary inoculation after a lapse of ten days. The necessity for this is difficult to be understood by the coolie, and it is not as easy to secure him for the second operation as it was for the first inoculation.

Besides measures against plague taken on land, efforts have been made to prevent the transfer of the infection into or out of the city of Manila. Vessels running between Manila and Chinese and other infected ports have been frequently fumigated with sulphur by the quarantine officials to prevent the possible introduction of plague-infected rats, while the interisland boats have been fumigated to prevent the carrying of infected rats from Manila to other points in the archipelago. Further, Chinese arriving at Manila have been detained until given prophylactic inoculations against plague.

The present condition in Manila with respect to plague should be relatively a cause for congratulation by the sanitary authorities. While the disease has certainly

acquired a strong foothold, it has never been able to prevail as generally as in other cities in which it has become established, although conditions here are such as would seem to favor its spread. The degree to which it has prevailed in the city is quite insignificant as compared with the great loss of life which it has produced in China and India. The calendar year 1903 has been one of the greatest plague years known. In Manila the total number of cases has fallen under 200 during the period of eight months, while in Hongkong there were 1,399 cases up to August 22. In India the ravages of plague so far this year have been frightful, and the official reports from Bombay state that in that city, with its total of 770,000 inhabitants, there have occurred during the three months from January 1 to March 31 no less than 11,052 deaths. Had plague prevailed in Manila to the same extent as in Bombay there would have been more than 3,000 deaths from this disease during the first three months of the present year. Compared with that for many other cities in the tropical Orient the experience of Manila may justly be regarded as fortunate, and fairly to be attributed to the effectiveness of the preventive measures employed. If it has not been possible to stamp it out as yet, at least the disease has been held down within reasonable bounds, and far more successfully than has been done in many places elsewhere. There is reason to hope that a continuation of the present sanitary policy may ultimately result in the extermination of the plague infection throughout the islands.

**QUARTERLY REPORT, EXCLUDING STATISTICAL TABLES, OF THE PRESIDENT OF
THE PROVINCIAL BOARD OF HEALTH, PROVINCE OF PAMPANGA.**

LETTER OF TRANSMITTAL.

PROVINCIAL GOVERNMENT OF PAMPANGA,
OFFICE OF THE PRESIDENT BOARD OF HEALTH,
Bacolor, Pampanga Province, P. I., March 14, 1903.

SIR: I have the honor to submit herewith the report of the board of health, province of Pampanga, for the quarter ending December 31, 1902.

Very respectfully,

F. W. DUDLEY,
President Provincial Board of Health, Pampanga.

The honorable the COMMISSIONER OF PUBLIC HEALTH,
Manila, P. I.

Two public vaccinators were employed for work in towns having no president of local health boards from November 28, 1902, to December 31, 1902, inclusive.

There are 23 towns in Pampanga, 14 of which have presidents of boards of health. Of these, 3 are graduates of medicine and 2 cirujanos ministrantes.

There are 6 licensed physicians practicing in this province and a full complement of mediquillos or curanderos and practicantes.

Cholera reappeared in this province on October 7, 1902. From October 7 to October 27 there were no cases, but from the latter date it began gradually to rise, reaching its height on December 20—21 cases. From that date it gradually declined, and at the close of this report—December 31, 1902—no cases were reported.

This later invasion did not partake of the nature of an epidemic, but was in fact sporadic in character. It was somewhat less virulent—the mortality during the epidemic having been 68.92, while the death rate during this quarter was but 60.65.

This recrudescence first appeared in the town of Porac on the 7th of October, 1902, and no other cases were reported in the province until October 27, 1902, when it appeared in the distant town of Arayat.

The cases at Porac, it is believed, were imported from Manila by train. The cholera was evidently introduced into Arayat from the town of Cabio, Nueva Ecija, where there were many cases, by means of the infection of the Rio Grande, upon which both towns are situated. A few days after the invasion of Arayat, Candaba, located on the same river, below Arayat, developed cases. The disease then spread to the following towns in the order named: Santa Rita, Minalin, San Fernando, Guagua, Mabalacat, Bacolor, San Miguel (Masantol), Betis, Macabebe, Magalang, Mexico, Angeles, and Santa Ana. Thus it will be seen that 16 out of the 23 towns in this province suffered. It is thought that the town fiestas, which began shortly after the infection of Arayat, are responsible to a great extent for the infection of the last 13 towns mentioned.

The immunity of the other seven towns can not be accounted for, save in one instance, where isolation might have been a factor. Some of these towns may have developed cases which were not reported.

It was noticed during both invasions of cholera, in the town of San Fernando, that certain districts of the town seemed to have a peculiar immunity. Upon investigation this was explained by the fact that the inhabitants of these districts used water from an artesian well at the railroad station. In the first epidemic it was noticed that most of the cases in the infected portion of the town could be traced to a certain well. When this well was closed cholera disappeared.

There is great difficulty in securing potable water in many towns of this province. Especially is this true of those towns situated on the estuaries of Manila Bay.

MEASURES TAKEN FOR THE PREVENTION OF CHOLERA.

Infected houses were disinfected and quarantined, together with their occupants. Contacts were cautioned in regard to boiling water and preparing food properly. Disinfectants were furnished for hands of attendants, and disinfection of stools and vomited matter.

CARE OF SICK.

Nursed by relatives in their homes. In the case of the poor, or where application was made, cases of cholera were attended free of charge by the provincial medical officer and the local presidents of health boards. All were allowed to elect their medical attendants.

DISPOSAL OF DEAD.

Buried in cholera cemeteries at a distance from a town soon after death 4 feet under earth. Lime used when obtainable.

HYGIENIC AND SANITARY CONDITIONS.

The hygienic and sanitary conditions of the province are above the average as compared with other provinces.

Town markets are not properly constructed. Food stuffs are handled too much by intending purchasers before reaching the consumer.

CUSTOMS AND HABITS OF THE PEOPLE.

Fecal matter, as a rule, is deposited beneath the closet upon the surface of the ground, and later is consumed by swine. The porkers are slaughtered, and finally are offered for sale in the public market.

Many of the better constructed houses and convents have water-tight vaults in the building, which are open above so as to liberate foul air and gases into the inhabited portions of the buildings.

In one town excavations beneath closets have been put into use, and the daily deposits are covered with earth.

Among the lower classes cleanliness as regards cooking and person is not what it should be.

One of the most serious menaces to the health of the inhabitants of this province is the practicante, mediquillo, or curanderos, as they are called. As a rule, they are ignorant, boastful, and dangerous to health, and even life. They frequently develop from a panholo (panjolo) hombre, or an hombre of the sementeras, in a few hours, and secure a pair of spectacles and some medicine, of which they know absolutely nothing, and hesitate not to give a diagnosis and promise a cure in all cases. Their fallacious theories, based upon ignorance, as regards the origin of epidemic disease, and which easily finds a resting place in the traditions of the superstitious, is the worst enemy of a worker endeavoring to introduce modern hygiene and sanitation.

DEATHS FROM VIOLENCE.

Deaths from external violence are not infrequent. As a rule, burial is given without medical examination, and often weeks and even months after interment prosecution of the person inflicting the injuries is instituted by the friends or relatives of the deceased. Medical testimony is then required to show whether or not the deceased met his death from injury or natural causes. The only evidence usually available is that of the practicante who attended the deceased.

OF ECONOMIC INTEREST.

There are two varieties of wild duck, indigenous to these islands, in abundance in this province throughout the year. They are called by some the Philippine mallard and cinnamon teal, but do not resemble either of these ducks as found in colder countries. During the latter part of January, February, and March there are a great abundance of migratory birds, which come from the north—China and Siberia—the principal varieties being green-winged teal, sprig, and spoonbills, etc. Ducks are trapped and sold in hundreds in provincial towns and Manila.

The Wilson, bull, and jack snipe are plentiful in January, February, and March. A bird resembling the coot is plentiful in the nipa swamps, and is called the tiroc or uis. There is also another bird called the ticling to be found in the same swamps. They are both trapped by the natives and prized for food. There are two varieties of stork eaten by the natives—one is a large bird, some blue, and some of a drab color; the other a small white bird.

Most fish of Manila Bay are in abundance here in the tide-water streams. There are no fish in the mountain streams. We have the rice paddy or mud fish in the sementeras. There are many fish ponds maintained by individuals. These ponds are stocked with fish brought from about Morong, Bataan, when very small. Oysters, clams, crabs, and shrimp are plentiful.

Deer and wild hog are found in numbers in the mountains. They are hunted with dogs and chased into nets set for the purpose. The flesh is sold weekly in towns bordering the mountains. The hunting season is best from the 10th of March until the beginning of the rainy season.

LOCUSTS.

Locusts attacked the crops, principally sugar cane and rice, in and about Angeles, Arayat, Mabalacat, Magalang, Mexico, Porac, Santo Tomas, Santa Ana, San Simon, and San Luis. They were numerous during October and November, but practically disappeared toward the end of December. Repeated attempts were made to inoculate locusts during October and the early part of November, but without any practical results. It was rather dry for such experiments, but there was some dewfall, and this was taken advantage of. The damage to crops amounted to about 25 per cent.

MEASURES TAKEN FOR THE PREVENTION OF RINDERPEST.

Isolation of carabao and destruction on appearance of first symptoms. Bodies of carabao dead from the disease to be burned with the hide. Isolation of herd and daily inspection for sick cattle.

Immunization not attempted for the reason that causes were not reported until some time after death.

RECOMMENDATIONS.

That artesian wells be bored at public expense in order to supply certain towns of this province with pure drinking water.

That means be devised to secure the examination of bodies of all persons dying as a result of violence by a government medical official before interment.

**REPORT OF SPECIAL SANITARY INSPECTION OF THE PROVINCE OF PANGASINAN,
BY DR. F. H. DUDLEY, SPECIAL INSPECTOR.**

BACOLOR, PAMPANGA PROVINCE, P. I., *July 18, 1903.*

SIR: I have the honor to submit herewith my inspection report of the province of Pangasinan.

Very respectfully,

F. H. DUDLEY,
President Provincial Board of Health, Pampanga.

The COMMISSIONER OF PUBLIC HEALTH,
Manila, P. I.

PROVINCE OF PANGASINAN,
Bacolor, P. I., July 18, 1903.

This province was inspected during the latter part of March, and the inspection completed during the first two weeks of July, 1903. Area, 4,174 square kilometers; population, census of 1903, 403,362.

ORGANIZATION.

The provincial board of health was organized on March 15, 1903, and the first meeting was held on that date, when local presidentes for health boards were appointed for 24 towns. There are 37 towns in the province under consideration, and but 22 of these have health boards. There are 8 vacancies and 7 towns unable to pay presidentes municipales de sanidad. Four towns, however, are looked after by local presidentes de sanidad from adjacent towns—Bayambang by the president of the health board of Bautista, Calasiao from Dagupan, Binmaley from Lingayen, and Urbistondo from Mangatarem.

There are two practicing physicians in the province besides the president of the provincial board of health, and both are presidents of local boards. There are 12 cirujanos ministrantes, of which 10 are presidents of local boards. Of the remainder of the presidentes municipales de sanidad 2 are medical students, 3 sanitarios del ejército español, and 5 of practical experience only.

Dr. John F. H. Slayter, who organized the board and was its first president, was succeeded by Dr. V. de Jesus in October, 1902. Membership of both boards are shown in Table No. 1 attached to this report. Table No. 2 gives population of the province by towns, based on the recent census. In Table No. 3 are the names of the presidentes municipales de sanidad, the towns to which they are assigned, their qualifications, date of appointment, and salary received by each.

DISEASES MOST COMMON IN THE LOCALITY.

The diseases most common in the locality are here given in the order of their frequency: Malarial fever, rheumatism, tuberculosis, pulmonary, beriberi, and diseases of the skin.

NOTE.—Five deaths from rabies during the past year.

Statistics of death not completed, and therefore it is impossible at the present time to give figures. This information will be furnished the commissioner of public health by the president of the provincial board of health, of Pangasinan, in his annual report for the year ending June 30, 1903. This report is now being prepared.

Table No. 4 gives the number of sick and wounded poor attended free of charge by the presidentes municipales de sanidad of the different pueblos.

EPIDEMIC DISEASES.

Dengue appeared in all the towns of the province between the months of April and December, 1902. It was very mild in character and no complications were noted. There were many cases of rubeola during the year passed. Gastro-intestinal catarrh was a common complication.

Smallpox.—Since the 2d of February of the present year, 10 cases of smallpox were reported as appearing in 9 pueblos. There were 4 deaths recorded from this disease. The patients were isolated, clothing and other effects in immediate contact with the sufferers were destroyed by fire. The dead were buried in lime 2 meters beneath the earth's surface. Since January, 1902, 12,000 units of vaccine virus have been used. Besides the presidentes of the local health boards, two public vaccinators have been employed since March last, and they have worked in towns where there are no boards of health. There were vaccinated 12,542 persons of which 6,375 were positive. Refer to Tables 5 and 6 for further information.

Cholera.—The first case of cholera appeared in the capital, Lingayen, on April 20, 1902. A woman, a resident of San Carlos, this province, was attacked after arriving in Lingayen and died. This case was at once isolated and all preventive measures taken. No more cases appeared in the capital until the month of June, shortly after the appearance of the disease in Binmaley, from which town it was reimported into Lingayen. The next town to report cases was San Carlos, which did so on May 20. This pueblo seemed to offer a favorable media for the propagation of the bacillus and it is believed served as a distributing center from which most of the other towns received their infection. San Carlos, after Dagupan, suffered most severely. The epidemic spread with great rapidity, frequently appearing in two different towns on the same date. Cholera is supposed to have been introduced into San Carlos from Manila by means of the railroad. The last case appeared in the town of Bautista on December 17, 1902. There were a total of 13,434 cases and 9,347 deaths, a mortality of 0.6957.

It was combated by the same methods as used in the other provinces. Hospitals, detention camps, instructions regarding food and drink, external and internal quarantine, inspectors (American and Filipino), disinfection, etc. Dead were buried in lime 2 meters beneath the sod. All instructions issued by the insular board of health were carried out as far as possible. See Table 7.

LEPROSY.

There are on record in the office of the provincial board of health 61 cases of leprosy, reported from 5 towns as follows:

Pueblos.	Cases.
Urdaneta.....	10
Tayug.....	5
Alcala.....	4
Aguilar.....	7
Salasa.....	35
Total.....	61

VENOMOUS SNAKES.

Usual varieties found in the valley of Central Luzon. Five deaths from snake bite were reported for the year just past.

HYGIENIC AND SANITARY CONDITIONS.

The hygienic and sanitary conditions compare favorably with the other provinces thus far inspected. Dagupan is a dirty town. The following remarks, taken from a report written by Doctor Jesus, president of the provincial board of health, sets forth existing conditions clearly:

"Las condiciones higiénicas y sanitarias de esta provincia son buenas, consideradas en general; algunos pueblos están enclavados en terrenos altos con buena calidad de agua y la mayoría les baña el río Agno, ó sus ramificaciones, como Mangaldan, San Jacinto, Pozo-rubio, Manaeag, Binalonan, San Manuel, Asingan, Tayug, San Nicolas, San Quintin, Santa María, Umingan, Balungao, Rosales, Villasís, Alcalá, Urdaneta, Santa Barbara, Calasiao, San Carlos, Bayambang, Bautista, Mangatarem, Urbistondo, Salas, Aguilar, Lingayen; otros son menos saludables por su situación y por la carencia de agua buena para el uso de sus habitantes, estando regados por ríos de agua salada, como Dagupan, San Fabian, y los últimos rodeados de espesos bosques con agua escasa y de mala calidad, como Alava, Malasiqui, Mapadan. En todos estos pueblos se ha iniciado algo la higiene y limpieza, aunque aún no lo bastante por la resistencia pasiva de la mayoría á cumplir los más rudimentarios preceptos de higiene y sanidad.

"Hay cinco de la provincia que son importantes por varios conceptos: Dagupan como punto comercial es de lo más importante, pero se halla en malas condiciones por carecer de buena agua potable á surtir las necesidades de su vecindario, tiene bastante descuidada la higiene y sanidad de la población, y su municipio se queja de no tener fondos para llenar las necesidades de las ordenanzas sanitarias; Lingayen es el centro oficial de la provincia, es sano y tiene algunos pozos que surten de buena agua; Bautista es otro pueblo comercial en buenas condiciones higiénicas y sanitarias; Sual es un pequeño pueblo, llamado á ser importante con el tiempo por su hermoso puerto, es en él endémico el paludismo por la vegetación de las montañas que le rodean; y por último, Tayug es de los hermosos pueblos, en cuyo casco de la población le surcan canales por donde corre agua cristalina, es el mercado de cuatro ó cinco pueblos que le rodean y es uno de los pueblos limpios y sanos de esta región.

"En todos los pueblos de esta provincia, los barrios son los que más dán mayor contingencia de mortalidad y esto se deberá porque ellos están generalmente enclavados en terrenos rodeados de bosques, palayeros, riachuelos, pantanos, y por la carencia absoluta de cuidados de sus habitantes."

Well water is used almost entirely. The military at Bautista has just completed an artesian well for the exclusive use of the army. There are sulphur springs at Balungao.

CUSTOMS AND HABITS OF THE PEOPLE RELATIVE TO HEALTH AND SANITATION.

Observations under this heading, as noted in reports on other provinces, apply to Pangasinan. The following excerpt from a letter written to the inspector by V. de Jesus, M. D., president of the provincial board of health, Pangasinan province, under date of April 30, 1903, describes accurately the conditions as they exist:

"Hasta la organización de las juntas provinciales de sanidad y los locales de los pueblos, estos tenían poca idea de higiene y sanidad, y si bien en algunos sus habitantes presentaban limpios y aseados, la costumbre general es el descuido tanto de si

mismos, como en la de sus habitaciones y solares—en sus enfermedades, atribuyen sus causas como su curación ó muerte más bien al fatalismo de la seúte que á los remedios que suelen propinarles sus mediquillos de los barrios, viendo con suma indiferencia los remedios de la medicina racional, sino con horror, por atribuirlos efectos venenosos. Gracias á la prodigalidad de los médicos militares destacados en los pueblos, van huyendo menos de los medicamentos farmacológicos, pues á muchos se los ha facilitado medicinas gratis y cuando han usado con constancia y según las instrucciones del que las dió, veían curar sus enfermedades, dejándoles con esto con alguna fé en los remedios.”

EPIDEMIC DISEASES AMONG ANIMALS.

Table No. 8 gives deaths of horses, carabaos, cattle, and hogs (estimated) from epidemic diseases, by towns, from July 1, 1902, to April 30, 1903. Glanders and surra are responsible for the loss of horses, and the carabaos and cattle died from rinderpest and foot-and-mouth disease. During September, October, and November, 1902, the hogs died of an epidemic disease unknown to the residents. All that could be learned was that diarrhea was a prominent symptom. This was followed by a loss of appetite, rapid loss of flesh and strength, and usually death in from four to ten days.

Last fall an epidemic disease was discovered among the carabao which was unknown to the natives of this province. It was characterized by an ulceration of the ear, which rapidly spread to the external auditory canal. There was a copious purulent discharge. It was treated successfully by warm antiseptic solutions and protecting the ear from flies.

ECONOMICS.

Langostas.—Grasshoppers appeared in this province in the early part of 1902 and are still present. They have visited during this time every pueblo in the province. Fungus was tried without success. The provincial board of health and the provincial board gave instructions for the people to destroy the saltones by the zanjas method, and good results were obtained in some districts. The president of the provincial board of health and others in the province estimated the total damage to all crops at 60 per cent. It is believed that this rather exceeds the damage actually suffered.

Agriculture.—This is the leading industry in the province.

Rice.—In normal years more rice is grown by far than in any other province or district of equal size in the Philippine Islands. It is shipped to Manila. But one crop is grown annually. There are 4 steam rice mills. There is some land in the province suitable to the cultivation of rice which has never been planted to it. There is much land formerly under cultivation which now lies idle, owing to the lack of draft animals, many having died from epidemic diseases. There are floods at rare intervals, which interfere to some extent with growing and planting of crops. Droughts are more frequent.

Lands.—The land is mostly level. Mostly owned in small tracts and tilled by owners. There is some government land, but it is mostly mountainous and worth nothing save for the timber thereon. There is no outside market for timber, and this fact alone makes the price so low as to prohibit any profit. Lack of cheap transportation is the cause.

Sugar cane.—But little grown.

Cocoanuts.—Great quantities; coprax and oil of the nut exported.

Pepper.—Some.

Coffee.—For home consumption only.

Vegetables.—Radishes, tomatoes, camotes, watermelon, eggplant, ube, gabe, tuge, lettuce, onions, garlic, and other vegetables. The Igorrotes grow large quantities of Irish potatoes.

Fruits.—All native fruits are grown, including lemons, limes, and oranges.

Cotton.—Native tree cotton only.

Nipa.—Sufficient is grown on the estuaries affected by the tide to roof the greater part of the houses in the province. Some vino is made. Houses near the mountains are roofed with grass.

Fish.—Both fresh and salt water fish are abundant. There are some private fish ponds.

Shellfish.—Turtle, crabs, oysters, clams, snails, and shrimp, etc.

Timber.—Much valuable timber. Some shipped to Manila from eastern part of the province by way of Bautista. Lack of transportation facilities and consequent high rates limit the exportation of timber to a very small amount.

Cacao.—For home consumption only.

Leather.—Some of good quality exported.

Hats.—Calasiao is noted for its hats of fine quality. They are plaited from a vegetable fiber. The fiber is of a different kind from that used in Bailuag, Bulacan Province. They are of all prices; the best grades sell as they leave the plaiter's hands at from \$20 to \$70, local currency, each.

Caña, Espinas.—For home use only.

Corn.—But little.

Salt.—Table salt, in crude form, is obtained from working the earth overflowed by tide water. The process is crude and peculiar to the natives. It is exported in large quantities. The average native will not use imported refined table salt if he can secure the native crude article.

Mines.—There are no exploited mines in the province. There is gold, coal, and copper, but in what quantities is not known. The Igorrotes have worked copper and gold mines on a small scale and by the most primitive methods near the town of Asingan.

Merchants.—Confined to the tiendas. They are Chinese and Filipinos, and the former have the advantage in the proportion of about 2:1.

Skilled workmen.—There are good carpenters, blacksmiths, silversmiths, wood carvers, etc.

Petates.—Some very pretty ones of artistic designs in colors are made.

Cloth.—A small amount of cotton cloth is made for home use.

Game.—Wild carabao, deer, hogs, ducks, snipe, chicken, quail, doves. The wild carabao are found near Umingan and San Nicolas.

REPORT OF TAYABAS PROVINCE, SUBMITTED BY W. H. COOK, PROVINCIAL HEALTH INSPECTOR.

MANILA, P. I., May 15, 1903.

SIR: Complying with Paragraphs VII and VIII, Special Orders, No. 30, dated Manila, P. I., March 9, 1903, I have the honor to report as follows:

TAYABAS PROVINCE.

Capital, Lucena; by boat from Manila to Cota, eighteen hours; to Lucena, 2½ miles; one-half distance by rowboat, one-half by fine wagon road. Carromata obtained from Lucena by telephone. Altitude, Lucena, 50 feet, estimated. Population, Lucena, 10,000; barrios, 17. Hygienic and sanitary conditions naturally good. Natural sloping surface in all directions from center of pueblo. Houses a suitable distance apart. Swift-running mountain streams on the east and west sides of town. The water for household purposes is procured from these streams, and is of sufficient quantity and good quality. The town washing is done in these streams at and below the fords; the drinking water is obtained above these points. The water is hard, lime impregnation, as streams run over and through limestone formation. The offal from pueblo's streets and lots is thrown into the river at and below fords, and a portion burned in outskirts of town. Sanitary condition is but fair, as there seems to be a lack of interest in condition, and not sufficient enforcement of sanitary laws.

Malarial fevers of the tertian type predominate. A large portion of the natives are anæmic, and during epidemic of cholera there were a number of cases of beriberi, but none have appeared since. About 7 per cent of deaths from tuberculosis. Average death rate is 51 in 1,000 for year of 1902. This includes 18 cases from beriberi and 250 from cholera. There are registered 513 deaths. There are registered 323 births. Ordinarily malarial fever, called "calentura," "tertian," and "fiebre palúdica" by the natives, is the cause of 70 per cent of deaths.

Cholera.—The first case, fatal, came from San Juan de Bocob, province of Batangas, about 12 miles distant. The epidemic lasted from June to November, the exact dates unobtainable. There were 500 cases. Statement of local practicante, municipal president, and secretary, 250 deaths. Quarantine rules were enforced as rigidly as possible. The bodies were covered with lime and buried in a separate burying ground apart from cemetery. Sick cared for by members of family or native nurses, under direction of American doctor or native practicantes.

Smallpox.—No cases during 1902. Vaccination was thorough; no virus for 1903 up to March 20.

A large majority of deaths among children, many living but a few hours, is due to inanition.

The people are advancing in their mode of living and regard to sanitary conditions. Much improvement will follow educating them in sanitary laws. They are industrious, and the fact that many men may be seen working in the fields is an indication of progression.

Surra.—Ninety per cent of horses died from surra in 1902, and fully that proportion of cattle and carabao. Cause, so called by natives, "epizootia;" probably rinderpest.

By the loss of carabao agricultural pursuits are suffering and transportation is expensive, owing to scarcity of horses. The presidente of this pueblo lost about 200 head of horses in 1902.

A municipal board of health has been organized and is in fair working order. Records are complete and well kept since July 1, 1902, when present board was organized. The attention of the president of the board was called to the unsanitary conditions that existed in the public market and in and about the municipal buildings.

Landing place for all freight and passengers is Cota, a place of about 250 population, in a very unsanitary condition. The presidents of pueblo and board of health have been notified—written notice—of the conditions, and a thorough policing recommended.

PAGBILAO.

Pagbilao, 8 miles east from Lucena, by pony, a fair trail. May be reached over a good road from Yayabas by carromata, 8 miles. Population, 6,000. Hygienic and sanitary conditions naturally good. Natural drainage. The sanitary conditions can be greatly improved. The water supply for household purposes is from a well near mountain stream; sufficient and of good quality; hard.

There is no provision for offal from pueblo. A portion is carried to edge of town and an attempt made at cremation, but the rule is not enforced.

Malarial fevers predominate (tertian form).

Death rate in 1902, 13 in 1,000. This includes deaths from cholera, 67.

Cholera.—First case from food brought from Manila. Seventy cases and 67 deaths. The sick were cared for by local native nurses under supervision of American doctor and native practicantes. The dead buried in separate tract of land, the body being first covered with lime. The epidemic lasted from July 17 to September 30, 1902. Strict quarantine rules enforced.

Smallpox.—No cases. Vaccination thorough in 1902. No virus at present time.

Dysentery.—No cases.

Tuberculosis.—Cases rare; about 3 annually.

Greater per cent of children die from inanition. People cleanly, industrious, and thrifty.

Surra.—Horses died during 1902, fully 90 per cent.

All cattle died, and 95 per cent of carabao from "epizootica."

Board of health consists of practicante and secretary of municipality, assisted by Doctor Altman, formerly of Hospital Corps, United States Army. A complete register of births and deaths kept. The president of board of health instructed in requirement of paragraphs 5 and 6, act 308, and attention directed to unsanitary conditions of several houses.

TAYABAS.

Tayabas, 8 miles from Lucena. Fine road for wagon or carromata. Elevation, 1,600 feet. Population, 16,000, includes 49 barrios. Hygienic and sanitary conditions naturally excellent and well seconded by board of health. A steep slope in all directions from center of town. Water supply from mountain stream. Canals of cement or concrete are on either side of main streets, and through these run swift-flowing streams of cool, fresh water from mountains. Above a designated point all water for domestic purposes is taken, and below the middle of town the water is used for bathing and washing. An ordinance imposes a fine of 5 pesos for any contamination of water in these canals, and is rigidly enforced. The diseases common to locality are malarial fever first, tuberculosis second, convulsions (inanition) third (1 to 22 March register). Malarial fever, 12 deaths; tuberculosis, 11 deaths; convulsions, (children) 10; epilepsy, sarna, tumor of stomach, accidental, each 1. In 1902 the death rate was 50 in 1,000. This includes 37 deaths from cholera. The epidemic of 1902 lasted from June 5 to September 30. First case fatal, a member of constabulary from Batangas Province, San Juan de Booboc. Strictest quarantine regulations enforced. Sale or consumption of fruits strictly prohibited. The sick cared for by natives employed under direct supervision of practicante, president of board of health. Bodies were covered with lime, over which was sprinkled solution of corrosive sublimate

and carbolic acid, and buried in a separate burying ground. No funerals or processions were permitted during epidemic.

Smallpox.—No cases. Vaccination thorough for 1902. No virus this year.

Surra.—Surra has destroyed 80 per cent of horses in this pueblo.

The "pest epizootica," probably rinderpest, has taken all cattle and 90 per cent of carabao.

Habits of people, cleanly, industrious, and very progressive.

An excellent board of health and doing good work. Minutes of meeting of board and records of births, deaths, and all successful vaccinations kept. Each member of municipal board, as well as president, are volunteer members of sanitary board.

LUCBAN.

Location, 8 miles from Tayabas, horseback. Impassable for carromata. Transportation by pack train or bearers. Altitude, 2,200 feet. Population, 12,000; barrios, 4. Water supply comes from mountain stream; abundant and of excellent quality—very cold. Hygienic and sanitary conditions are excellent. The water system is superior to any. In addition to the canals on either side of street through which the cold water rushes a sewerage system obtains. By damming the street streams at upper or higher point, the water is conducted through a lateral canal to a line of canals in rear of houses where it enters a canal parallel with street. Over this branch are constructed the latrines and closets, and the upper portion used for bathing purposes. Below a prescribed district in the street the town washing is done. Ordinances against pollution of this stream are very strict and rigidly enforced. During months of November, December, and January pneumonia among adults quite frequent. February to August, malarial fevers. A few cases of dysentery occur annually. About 60 per cent of deaths from malarial fevers. Inanition cause of great death rate among children.

Cholera.—Introduced from Laguna Province. Raged from May until November—45 cases with 30 deaths. Strict quarantine rules enforced. Fruit market closed during epidemic. No funerals nor processions permitted. Dead buried in separate ground; bodies covered with lime. In barrios the bodies were buried in lime near place of death.

Smallpox.—No cases. Vaccination thorough in 1900. No virus this year.

Diseases among horses, glanders and surra; 80 per cent have died during past two years. All cattle have died from "epizootia," 90 per cent of carabao.

Board of health in good working order.

Habits of people, cleanly, industrious, and progressive.

Climate of this pueblo is very damp. The houses and all buildings and walls are covered with a heavy growth of moss, and fogs are of almost daily occurrence.

SARIAYA.

Sariaya, 8 miles from Tayabas, a good road for carromata or wagon and an equal distance from Lucena via trail for horseback or pack train. Altitude, about 1,600 feet. Population, 12,000, including Candelaria, which has been annexed. Hygienic and sanitary conditions naturally excellent. Water system like Tayabas. The diseases common to locality are malarial fevers with tuberculosis and dysentery. Ten per cent of deaths from tuberculosis.

Cholera epidemic.—From June 15 to October 30, 1902, 400 cases (estimated), 138 deaths. First case came from San Juan de Bocboc. Strict quarantine rules. Patients cared for by nurses (natives) employed by board of health. Each house was quarantined and a guard placed over same. Dead buried in separate grounds; bodies covered with lime. Vaccination thorough in 1902. No virus this year. Children suffer from inanition. Economic conditions excellent.

Surra.—Surra has destroyed 85 per cent of horses.

Cattle and carabao exterminated by "epizootia" and tetanus (?).

Board of health convened March 22 and American school-teacher added, completing organization. The paragraphs 5 and 6 read and explained to board. Attention invited to an unsanitary district and measures recommended for drainage of small area that in the wet season is a menace to public health. Minutes and records of board well kept. All members of sanitary board of this pueblo, as well as all visited thus far, are engaged as census enumerators, and local affairs in re municipality at a standstill.

CANDELARIA.

Candelaria, 8 miles from Sariaya, about same altitude. Roads good. Transportation by pack train. Water supply from mountain stream ample and of good quality. Population, about 250; a barrio of Sariaya. San Juan de Bocboc, Batangas, is shipping point, about 7 miles distant. Town has deserted appearance. Hygienic and sanitary conditions naturally good. A telegraph, United States Signal Corps, connects this place with Tayabas and Lucena. Telegraph lines are being built to connect Lucban and Pagbilao with these points, making connection more rapid.

TIAON.

Tiaon is 15 miles from Sariaya and 7 miles from Candelaria. Roads fair. Population, 8,000; 16 barrios. Hygienic and sanitary conditions naturally fair. Sanitary conditions could be greatly improved. Natural drainage for pueblo. Water supply from mountain spring, ample and good quality. Pneumonia exists during months of March and April. Dysentery and cholera during May and June. Malarial fevers, tertian, predominate. Deaths exceed births.

Cholera.—Cholera introduced from Laguna lasted from June 5 to late in July. Cases estimated, 200 (?); deaths, 144. Strict quarantine regulations were enforced as far as possible, but ineffectual owing to inability to pay for patrol or police. Sick cared for by native nurses or members of families afflicted. Dead buried near place of death; bodies covered with lime; a few were cremated. Six houses were burned.

Smallpox.—No cases. Vaccination was thorough in 1902. As yet no virus has been received this year.

Tuberculosis.—Few cases.

Habits of people, cleanly, sober, and industrious. Large tracts of land are being cleared of native foliage between Tianon and Sariaya preparatory to planting coconut trees.

Surra.—Surra has taken about 85 per cent of horses during past two years. Cattle and carabao have been practically exterminated by "pest."

Municipal board, none at this place. The presidente of municipality takes place of all; is a hard worker but greatly handicapped, owing to poor financial conditions of pueblo. One of the poorest pueblos in Tayabas Province, being the gateway to Laguna and having suffered from malcontents, ladrones, and last during "reconcentration" this pueblo is in straits. A large hot mineral spring is near this pueblo. The waters are said to be strongly astringent and presidente reports that American army doctor used the water in a number of cases of dysentery with very beneficial results. A register of births and deaths is kept, but very unsatisfactory. The death rate exceeds the birth rate. Unable to organize board of health, but instructed presidente in the necessity for keeping records of births and deaths and, so far as possible, all causes of deaths.

The people are anxious for schools and will gladly raise money for a teacher in preference to paying for services of practicante.

A practicante lives at Candelaria and one at San Pablo, in Laguna, and they are sometimes called to see the sick. This pueblo has recently been visited by a fire which destroyed 38 houses, including the town bakery.

SAMPALOC.

Sampaloc is about 8 miles from Lucban, over a very rough trail, almost impassable for horse or pack train. In a distance of 2 miles toward Lucban, a mountain climb of about 2,000 feet over boulders, in wet season almost impassable for foot passengers; more easily reached from Mauban, on Pacific slope. Road from Santa Cruz, province of Laguna, intercepts this trail about $1\frac{1}{2}$ miles from Lucban. Population, 1,500; 12 barrios. Hygienic and sanitary conditions naturally good. Water supply, running from mountain streams, ample and of good quality. Running water in canals like Tayabas and Lucban. Habits of people cleanly, sober, and industrious.

Cholera and smallpox.—No cases.

Horses.—Eighty per cent died from "epizootic." All cattle and 95 per cent of carabao died from "epizootic" in 1901-2.

Vaccination thorough in 1902. No virus as yet for 1903. No board of health and no material for one. The presidente unable to speak Spanish or English, and but one member of council, the secretary, able to. All officers busily engaged in census taking. This pueblo is poor financially and has a deserted appearance. People are cleanly, industrious, and progressive.

MAUBAN.

Mauban, on Pacific coast, is about 8 miles from Sampaloc. Fair trail for pack train or horseback. More easily reached from coast-guard boat; four hours sail from Alabat, in fair wind; eight hours by trail from Lucban, via Sampaloc. Population, 14,000; barrios, 30. Hygienic and sanitary conditions naturally excellent, and improved by work of board of health and municipal authorities. Water supply, from mountain spring, ample and of excellent quality; soft. The water is brought to a public fountain, inclosed by concrete structure, kept perfectly clean. All water is taken from this fountain. Falling from this fountain, the water escapes by canals, and below is the bathing and washing place for the natives. From this point the stream runs to and flows into the sea, about 300 yards distant. The offal from houses and streets is hauled away and dumped into the sea. Tins are used for urinals and emptied daily. No closets are permitted, and the earth under the houses shows no filth. Hogs are kept out of town and very few dogs permitted to run in streets. A dry-earth closet is used in many cases. The market is separate and isolated and clean. Malarial fever, tertian form, predominates and is cause of 80 per cent of deaths. Death rate, 53 in 1,000, 1902, includes 38 account of cholera. Births exceed deaths by 150.

First case of cholera came from Laguna. Two seasons—first, from June 15 to 24; second, in month of September; 40 cases, with 38 deaths. Strictest quarantine rules enforced. Sick cared for by practicas, nurses, native, under supervision of American army doctor stationed with United States troops. Bodies cremated and houses thoroughly disinfected. During epidemic an isolated house was used as hospital and immediately upon appearance of case patient was taken to hospital and house quarantined until thoroughly fumigated and disinfected.

Smallpox.—No cases. Vaccination was very thorough in 1902, but as yet no virus received this year.

Dysentery.—None.

Tuberculosis.—None.

Beriberi.—A few cases, sequel of malaria.

Catarrh of lungs among adults and bronchitis among children in December, January, and February.

Habits of people cleanly, sober, and progressive.

The majority of the municipal officers speak English sufficiently to transact business. During vacation an Englishman from Hongkong is employed to teach English.

A fine mineral spring on property of presidente, about 2 miles distant, said to be sure cure for contagious diseases and excellent in rheumatism. Coal exists about 2 miles south of pueblo and about 1 mile from deep water. Gold has been found in rocks of streams. This pueblo is a large shipping place for Spanish companies dealing in hemp. The entire population of pueblo and barrios engaged in preparing and shipping hemp.

Habits of natives cleanly, and there is a marked contrast in the skin of the legs and arms as compared with natives of Alabat. Very few show the scars due to sarna.

Board of health has closed the old cemetery and a new one established away from the town and below the river mouth on the coast. Board of health in excellent condition, and all members of council are volunteers in sanitary work. Request fungus for extermination of flies.

LAGIAMANOC.

Lagiamanoc, three hours steaming by boat from Lucena port, may be reached by rough trail 20 miles from Pagbilao. Situated on high bluff, 80 feet, overlooking the sea. Has a fine small harbor. Population, 1,000; includes 8 barrios. Hygienic and sanitary conditions naturally excellent. Water supply, from mountain stream, ample and of good quality. Offal from street dumped over cliff and occasionally set on fire. Very few cases malarial fever. Total deaths, all causes, from August 25, 1902, to March 8, 1903, 20. Extremely healthy locality.

Cholera.—No cases in pueblo or barrio.

Smallpox.—No cases. Vaccinations thorough in 1902. No virus received this year. Three years ago all live stock, horses, cattle, and carabao died from "epizootic."

Register of births and deaths kept since August 25, 1902, but incomplete. The municipal officers engaged in census taking.

People are cleanly and industrious. Boat building and lumbering are the principal occupations of this locality, the lumber being cut near at hand from mountains.

ANTIMONAN.

Antimonan is on Pacific coast, $7\frac{1}{2}$ miles from Lagiamanoc, over a rough mountain trail on foot, as horses are procured about $3\frac{1}{2}$ miles from the latter place. Population, 14,000; has 42 barrios. Hygienic and sanitary conditions naturally good. Water supply, from shallow 8-foot wells, ample, but of poor quality; soft, but brackish. Town offal carried out of town and thrown into sea. Diseases common to locality are eclampsia, malarial fevers, tertian form.

Cholera.—One case, native; body covered with lime and buried in separate tract of land. Quarantine rules enforced by troops and natives under the supervision of American army doctor stationed with troops.

Smallpox.—One case; body buried after being covered with lime. Vaccination thorough in 1902. No virus received this year.

Dysentery.—Very rare.

Tuberculosis.—Cases rare.

Diseases of children, inanition, due to low vitality. Economic conditions excellent. No disease at present among horses, cattle, or carabao. Municipal board ordinance requires immediate report of each death, of actual or supposed cause. A fine of 5 pesos for failure to report.

The people are progressive, cleanly, and industrious.

Municipal board of health organized and in excellent working order. The military surgeon at this place has been of great benefit in teaching the members of the board sanitation. Death rate in 1902 was 33 in 1,000. Deaths exceed births 101.

Leprosy.—There were 2 cases of leprosy at this station. One died on March 25; the other is isolated and a rigid quarantine maintained. The cases were reported. Board of health urge that this case be taken to Manila as early as possible.

The board of health is in fine working order and every member of municipal government is active, and there is perfect harmony in all their work. The surgeon stationed at this place takes great interest and is of great value to the board in its work. United States signal station at this point, and communication with Lopez, Gumagagar, and Lucena.

GUMAGA.

Gumaga is on Pacific coast, 9 miles from Antimonan. Good trail for horseback or pack; telegraphic communication. Population, 5,500; 28 barrios. Hygienic and sanitary conditions poor; low, and no natural drainage. Water supply, from shallow wells, ample, but of poor quality; very brackish. The prevailing disease, malarial fevers. Deaths, 50 in 1,000, exceed births by 96 for year 1902; 112 deaths from malarial causes.

Cholera.—Unable to learn mode of introduction. Was in Macaldon and Barnot barrios; 12 in former, 8 in latter. Strict quarantine enforced by municipal authorities. Bodies covered with lime and buried near place of death. Attended by municipal assistants.

Smallpox.—No cases. Vaccination thorough in 1902. No virus secured for 1903.

Dysentery.—In 1902 there were 18 cases of dysentery.

Tuberculosis.—Cases rare.

Beriberi and rheumatism among adults. Eclampsia and convulsions among infants.

Economic conditions, poor. No board of health. There is a practicante, who, with municipal presidente and secretary, constitute the board. Register of births and deaths kept. No meetings of board and poor record of sanitary work. The pueblo is very poor and the policemen are not paid. Fully one-third of the houses are vacant. Presidente states that the occupants have gone to the country to plant rice. The entire place has a deserted appearance. The people are dirty and hungry looking.

No deaths of horses, cattle, or carabao, recorded last year; no epidemic existed.

LOPEZ.

Lopez, on Pacific coast, 15 miles east from Gumaga. Transportation, horseback and pack train; trail bad. Population, 8,000, including 45 barrios. Hygienic and sanitary conditions, naturally good. Water supply, from shallow wells, ample, but poor quality. Malarial fevers predominate. Death rate, 6 in 1,000; births exceed deaths 19.

Cholera.—No cases.

Smallpox.—No cases. Vaccination thorough in 1902. No virus received for 1903.

Dysentery.—Rare.

Tuberculosis.—Three cases from July 17, 1902, to date. Sarna abounds; 2 deaths. Malnutrition is cause of death among infants.

People are cleanly and industrious. Economic conditions, fair. No disease among horses, cattle, or carabao since 1901. Board of health organized and in good working order. A full and complete register of births, deaths, and minutes of meetings of board. A complete list of all vaccinations is kept.

This pueblo is in a mountainous district and the climate is very damp. During dry season heavy fogs continue well through each forenoon. The people are very progressive. All over this vicinity there is a great amount of building. The order directing that the people living away from pueblos should form barrios is being carried out, and little groups of houses, all more substantial than the common "shack," are being constructed. Signs of progression and thrift appear on all sides.

CALAOAG.

Calaoag, 9 miles from Lopez; about one hour's ride, saddle horse; two hours by banca.

Population, 3,000; barrios, 8. Water supply obtained from wells and rain water. Supply scarce at present, owing to exceedingly long, dry season. Deaths, 40 in 1,000; malarial fever, tertian, cause of large majority. Births exceed deaths by 4 for 1902.

Cholera.—No cases.

Smallpox.—No cases. Vaccination very thorough in 1902. No virus received for 1903.

Dysentery.—Cases rare.

Beriberi.—A few cases following malarial fevers. Children die from feeble constitutions.

Economic conditions, good. People are cleanly, industrious, and progressive. Municipal board of health organized and in good working order. The members of each barrio, 8 in all, are members of the municipal board of health. All take great interest and are progressive. At a meeting called for the purpose, act 308 was very thoroughly discussed and paragraphs 5 and 6 explained and studied till all thoroughly understood. The records have been fairly well kept, but the board has not been instructed in the meaning of paragraph 6 and expressed chagrin at their ignorance.

GUINAYANGAN.

Guinayangan, on the Gulf of Bagay, 30 miles by banca and trail or 25 by trail following telegraph line direct. Hygienic and sanitary conditions, fair. Population, 2,500. Water supply is from shallow wells and poor; has a salty taste. Best and deepest well is about 8 feet, with 18 inches of water. Water, domestic purposes, is obtained here (wells). The bathing is in pools of water in river bed 1 mile distant. Owing to exceeding dry season there is no stream now. In memory of oldest inhabitant the river was never known to be dry before. Malarial fevers, tertian, predominate. Deaths exceed births in 1902, 109.

Cholera.—Supposed to have been introduced through fruits or foodstuffs from Manila. Epidemic lasted from October 7 to November 28, 1902; 216 cases, with 32 deaths. Rigid quarantine rules enforced. Sick cared for by local police, specially employed natives, and practicante. Bodies were cremated and houses burned.

Smallpox.—Seven cases; no deaths.

Dysentery.—None.

Tuberculosis.—None.

Beriberi.—Ten cases after tertian fevers. Death rate, 60 in 1,000 in 1902. Vaccination thorough. Of 90 cases 53 were successful.

People are cleanly and industrious. Fifty per cent of horses died from surra. All cattle and about 80 per cent of carabao died from "pest" in 1901. Board of health organized, but records show lack of interest in sanitary conditions of pueblo. At a called meeting the members were very carefully instructed in their duties and instructed to insist on municipal government enforcing law against hogs and dogs running in droves through the streets. Hogs and dogs seem to overrun the town. The board of health will direct that a cart be hired to remove offal from the streets; that offenders against ordinances be fined. This is one of the richest pueblos in the province and richer than some provinces. There is no reason why sanitation should not be much better, and board of health so informed. Presidente requests that he be supplied with fungus for extermination of locusts.

ALABAT.

Alabat may be reached from Calaoag by banca, five hours' rowing, or from Antimonan, six hours' sail, fair wind, crossing Lamon Bay. Population, 4,500; barrios, 24. Hygienic and sanitary conditions naturally good, enhanced by work of municipal

board of health. Water supply from wells; average depth, 12 feet; water is hard. Offal is thrown into the sea. No closets permitted. Tin cans are used for urinals. Elevated platforms for closets are constructed over tide water at outskirts of town, to be used by natives. Malarial fever predominates, tertian form. Average death rate, 35 in 1,000. Deaths exceed births for 1902, 33.

Cholera.—Introduced from Antimonan. Epidemic from October 8 to November 9, 1902; 34 cases, 26 deaths. Strict quarantine rules enforced. Sick were cared for by local native nurses and practicante. A police was stationed over each house suspect and no communication permitted. The houses thoroughly fumigated after death. Bodies covered with lime and buried away from pueblo.

Smallpox.—No cases. Vaccination thorough in 1902. No virus thus far.

Dysentery.—Cases rare.

Tuberculosis.—Cases rare.

Sanitary conditions good. People are cleanly, sober, industrious, and progressive. Horses, very few; few deaths. Seventy-five per cent of cattle and carabao died in 1901 and 1902 of rinderpest. No cases of epidemic now.

Board of health organized and in good working order. Municipal president and all members of council active assistants to board.

SILANGAN.

Silangan, at extreme southeast end of island of Alabat. Five hours by banca, rowing, or three hours over rough trail from Alabat. Population, 200. Hygienic and sanitary conditions, fair. Town is very clean and the lieutenant of the barrio takes great interest in its sanitary condition.

Water supply for household domestic purposes, taken from well about 10 feet deep. Supply ample and of good quality. Well is protected, being fitted with a cover which is secured by lock and key. Each night at sunset the well is closed for the night. Malarial fever, tertian form, predominates.

Cholera.—No cases.

Smallpox.—No cases.

Births, estimated, 100; deaths, estimated, 70.

All cattle died in 1901 and 1902, and 500 carabao from "pest"—rinderpest. There are no horses. No means of transportation other than boat. Numerous cases of herpes exist. One case of leprosy. Board of health urge that case be removed.

SINGININ.

Singinin is five hours by banca, rowing, from Alabat. Population, about 250. Water supply, from mountain stream one-half mile from barrio, ample and of good quality. But little sickness. Unable to get history, as few speak but a few words of Spanish. Town is fairly clean. The people are engaged in lumbering and cleaning tracts of land for agricultural purposes.

Near Alabat, about 2 miles from the coast, is a deposit of coal. During Spanish times a steamer took 40 sacks out. The United States coast transport *Samsui* is lying here waiting for coal from a lighter and has some samples aboard.

BOAC, MARINDUQUE.

Boac, Marinduque, four hours' steaming from Cota, port of Lucena. Elevation, about 30 feet. Population, 15,000; districts, 11. Hygienic and sanitary conditions, naturally good. No permanent arrangements for disposition of offal. Water supply, from mountain stream, ample and of good quality. Malarial fever, tertian form, predominates. Death rate, 56 in 1,000. Deaths exceed births, 1902, 297.

Cholera.—First case from Gosan. Epidemic lasted from July 3 to September 13, 1902. Deaths, 70. Sick cared for by local assistants. Quarantine rules enforced by native police. Dead buried in separate district, bodies first covered with lime.

Smallpox.—No cases. Vaccination thorough in 1902, and 638 vaccinated in January. Virus badly needed.

Dysentery.—Thirty-one deaths from this disease in 1902.

Tuberculosis and disease of the lungs.—Three hundred and four deaths.

Deaths from all causes, 848. Sanitary conditions, poor. Pest destroyed 184 horses and 209 head cattle; also destroyed 1,713 head carabao.

Board of health held last meeting on 12th of November last. The practicante will not serve and all officials are having an overhauling. The town is poor financially, but there is a prospect of great improvement, as the governor has started the municipal authorities to work. Records of births and deaths and vaccinations are well kept. No attempt made at reorganization of board of health. At suggestion of governor matter was postponed.

MOGPOG, MARINDUQUE.

Mogpog is half-hour drive by carromata, over a very rough road, very bad in rainy season, as soil is of clay formation. Population, 7,000; 25 barrios. Hygienic and sanitary conditions, naturally poor. Situated on low, level ground. No facilities for drainage. Water supply, from mountain stream, ample and of good quality. No arrangement for disposition of offal, or any attempt at sanitation. Cause of majority of deaths, malarial diseases. Death rate, 1902, was 104 in 1,000. Deaths exceeded births by 473.

Cholera.—No cases.

Smallpox.—No cases. No vaccinators or practicanes.

Dysentery or tuberculosis.—Cases rare. Natives dirty, indolent, and careless.

Death of live stock, 1901 and 1902, is as follows: In 1901, horses, none; cattle, 11; carabao, 332 died of pest. In 1902, horses, 200; cattle, 100; carabao, 1,000 died of rinderpest.

No material for board of health at this place. The municipal secretary is the only person able to transact business, and is the head of all affairs and keeps a record of births and deaths of population and other animals. Presidente and clerks occupied in census taking. This is the poorest town in Tayabas and the governor is debating the subject of annexing it to Boal.

GASAN, MARINDUQUE.

Gasan, by steam from Boac, one hour. Carromata, three and one-half hours, over fair road. Population, 8,000; 14 barrios. Hygienic and sanitary conditions naturally excellent, and all possible done by board of health to make this place the cleanest and most sanitary town in Tayabas. Water supply is from wells near river. For domestic purposes a deep well centrally located is kept locked, except at certain hours during the day, when the people get water for drinking purposes. Excreta and offal carted away and thrown into sea. Malarial fevers, tertian form, predominate.

Cholera.—First case came from Manila. Epidemic lasted from July 2 to September 13, 1902; 300 cases, 200 deaths. Strict quarantine rules enforced and carried out under direction of Mr. Lamb, an American and an army officer. Water for drinking purposes boiled. Sick cared for by native nurses, who were quarantined with the sick. Death rate, including cholera, for 1902, 106 in 1,000. Deaths exceed births by 297.

Smallpox.—None. Vaccination thorough in 1902. No virus for 1903.

Dysentery and tuberculosis.—Rare.

Beriberi.—A few cases follow calentura annually. The majority of deaths of children due to inanition and feeble constitution. Habits of people cleanly, industrious, and progressive. In 1902, 8 horses, 3,057 cattle, and 1,032 carabao died of rinderpest.

Board of health organized and in good working order. Minutes full and well kept. No dogs or hogs permitted to run at large. This pueblo is the cleanest and in the best sanitary condition of any in the province, and this condition is due to the hard work of the municipal board of health. It is a noticeable fact throughout the province that where the medical officers of the Army have given assistance the sanitary conditions are far superior to localities that were without.

TORRIJOS, MARINDUQUE.

Torrijos, by steam, four and one-half hours; road, trail, a long and hard trail, one day. Population, 5,000; barrios, 16. Water supply obtained from river, but owing to exceedingly dry season the drinking water is brought 2 kilometers from mountain stream. Hygienic and sanitary conditions naturally excellent. Offal is burned or thrown into the sea. Malarial fevers predominate. Death rate for 1902, 160 in 1,000. Births exceed deaths 45.

Cholera.—None.

Smallpox.—None. Vaccination thorough in 1902. No virus in 1903.

Tuberculosis.—Rare.

Children die from inanition. Dysentery appears in a number of cases. Economic conditions, poor. Habits of people, cleanly and industrious.

Eighty per cent horses, 95 per cent cattle, and 80 per cent carabao died in 1901 and 1902. No epidemic at this time.

Board of health, none. Record of births and deaths kept by secretary. No material for board of health.

Two or three years ago this pueblo was noted for numerous herds of cattle grazing. The pest took them all. This season is extra dry, and all rice and grain that was planted has been burned and the hills are barren and have a dry, burned appearance. Naturally a fine grazing region. The country now has the appearance of a desert. The pueblo has a deserted appearance, and but little life exists in the native.

SANTA CRUZ, MARINDUQUE.

Santa Cruz, four hours' steaming from Boac or Torrijos; six hours horseback by trail, rough and rocky. Population, 16,000; 16 barrios. Hygienic and sanitary conditions naturally good. Water supply, domestic purposes, for greater portion of inhabitants is taken from mountain stream; ample and of good quality. The lower portion of pueblo gets water from lower down stream, and a greater portion of it is covered with green vegetable scum, and here the water is of poor quality. Offal and excreta burned or dumped in stream below town. Malarial fevers, tertian, obtain. Death rate, 37 in 1,000. Births exceed deaths by 150 for 1902.

Cholera.—None.

Smallpox.—None. Vaccination thorough in 1902; 190 vaccinations this year, but no virus to complete vaccinations.

Dysentery.—Sixty-eight deaths in 1902.

Tuberculosis.—Fifty-one deaths, 1902.

Malarial fevers and sequelæ, 178.

Inanition, malnutrition causes of great number of deaths in infants.

Two hundred and sixty-nine horses, 3,031 cattle, 2,448 carabao, died of pest in 1901 (rinderpest).

Board of health, excellent and doing good work. Paragraphs 5 and 6, act 308, complied with. All municipal officers are earnest and hard workers. The municipal code is in Tagalog and shows much use.

The entire island is suffering greatly for want of rain. In most sections the rice crop has been a complete failure. The cocoanuts are beginning to fall, owing to burning, lack of moisture. This, with extermination of horses, cattle, and carabao, puts the entire population in straits. On this island there are mineral deposits, copper, gold, and iron. Also large guano deposits. A prospector named Cook has about consummated the sale of a "guano" location.

UNISAN, TAYABAS.

Unisan, three hours steam, eight hours by banca from Lucena. Situated just above sea level. Hygienic conditions, good. Water supply for domestic purposes from shallow wells, ample and of good quality. Population, 2,800; births, 56; deaths, 64 in 1902.

Cholera.—None in pueblo proper. In barrio Santol there were 6 deaths from cholera. Houses were burned, bodies buried with lime near place of demise. Offal from town is burned.

Smallpox.—None. Fresh supply of virus received on April 14, 1903.

Dysentery.—Rare.

Tuberculosis.—Numerous cases; phthisis among aged.

Malarial fevers predominate. Economic conditions, fair. People cleanly and industrious. Twenty horses, 5 cattle, 200 carabao died in past year of rinderpest.

Board of health, composed of presidente, a practicante, municipal presidente, and municipal secretary, hold meetings at regular sessions with municipal officers and discuss questions pertaining to sanitation of pueblo. Main industry, boat building (of pueblo). Records fairly kept.

PITOGO, TAYABAS.

Pitogo, four hours' rowing by boat from Unisan. Population, 3,372; 22 barrios. Sanitary conditions, naturally healthy location. No arrangement for removal of offal. A portion is burned in streets in front of houses. Births, 107; deaths, 644, including 363 from cholera which was introduced from Maceleon. Duration of epidemic from September 6 to November 4, 1902. Sick were cared for by members of family. Bodies burned in lime near place of death.

Smallpox.—No cases. Vaccination thorough. Fresh virus received April 15, 1903.

Water supply for domestic purposes procured from deep wells in sandstone formation. Many cases of dysentery from February to July.

Tuberculosis.—Thirty deaths during 1902.

Economic conditions, poor. People are lazy and dirty and seem indolent. Two deaths of carabao this year. No diseases among horses and cattle.

Municipal presidente, practicante, and secretary constitute a board of health. All instructed in duties required of board, and attention called to paragraphs 5 and 6, act 308. Records are very poorly kept. President will visit Lucena April 18, and is instructed to procure official register, births, marriages, and deaths, and taught how to keep same.

MACALELON, TAYABA

Macalelon, two hours' sail from Pitogo, may be reached overland by hard trail. Population, 5,000; 19 barrios. Sanitary conditions fair. Water supply, from shallow wells, is ample and of good quality. Offal from town is burned at outer edge of town at intervals. No record of births. Deaths, 576, including 316 from cholera, which lasted from September 7 to November 21, 1902. Sick were cared for by members of families and special and local help. Bodies were buried in lime near place of death. Quarantine rules, such as guarding by special municipal police, enforced.

Smallpox.—No cases. Vaccination thorough. Fresh virus received April 15, 1903.

Dysentery.—Few cases.

Tuberculosis.—Few cases.

Children die from "convulsions." No horses or cattle. Ninety-two carabao died in 1902.

Practicante, who is acknowledged head of sanitary board, can not speak English or Spanish and is unfit to serve. Municipal presidente and all officials seem indifferent and not inclined to perform their duties. Economic conditions very poor. Records very poorly kept. Secretary instructed to procure books, register of births, marriages, and deaths, and instructed to use them. The presidente directed to clean his town and keep it clean. The people are indolent and dirty. Dirtiest in province of Tayabas.

GENOSO, TAYABAS.

Genoso, a barrio of Macalelon, should be the pueblo, and deserves praise for sanitary conditions, naturally good. The conditions are improved by care and attention of headman and his supporters. No closets or urinals are in the houses or near them. The natives repair to districts designated for public use and partially made private by brush screens.

CATANAUAN, TAYABAS.

Catanauan, six hours boat from Genoso. Population, 4,000; barrios, 8. Sanitary conditions good. Water supply, from wells 12 to 15 feet deep, ample and of good quality. Offal is carted out of town and burned weekly. Malarial fevers predominate. A great many natives suffer from ulcers on feet and ankles. Births, 125; deaths, 183.

Cholera.—None.

Smallpox.—None. Vaccination is thorough.

Dysentery.—Few cases.

Tuberculosis.—Few cases.

Many deaths among children due to malnutrition. Economic conditions good. Habits of people cleanly, industrious, and progressive. No disease among horses, cattle, and carabao.

A provisional board of health, consisting of municipal presidente, secretary, and a practicante, which does good work in keeping pueblo in a sanitary condition. No closets or urinals are allowed in pueblo. Fines are imposed and collected for violation of rules. The streets are very clean and houses are dry and clean underneath. A good road connects this pueblo with Mulanay, which may be reached in one-half hour by native pony.

MULANAY, TAYABAS.

Mulanay, five hours by sailboat and rowing from Catanauan. Population, 1,700; barrios, 8. Hygienic and sanitary conditions good. Water supply, from wells 12 to 15 feet deep, ample and of good quality; from limestone formation. Offal from the town is thrown into the sea at low tide. Births, 122; deaths, 206, in 1902.

Dysentery and tuberculosis, rare. Malarial fever, tertian form, a great many cases. Many deaths among young children, due to malnutrition.

Loss of live stock during 1902, 300 horses, 500 carabao, and 4,000 cattle.

Cholera.—None.

Smallpox.—None. No virus; no vaccinator. Catanauan has sufficient virus and has been notified to vaccinate children here.

Herpes.—A great amount of this among children; 35 cases during past year.

Board of health, none. Records, provisional, are well kept. Secretary instructed to secure proper register of births, marriages, and deaths. Main industry, cattle raising. Municipal officials meet monthly as sanitary board, and the pueblo is in good condition. People are cleanly and industrious and seem interested and respect sanitary rules.

BONDOG, TAYABAS.

Bondog, five hours by sail or oars from Mulanay; one day by a rough trail. Population, 1,434 (?); barrios, 8. A mountain stream and three wells supply water for domestic purposes, of good quality. Sanitary conditions fair. Offal from town is burned in front of houses in streets. Malarial fevers, tertian form, with dysentery and beriberi in the order named are principal diseases of locality. Births, 44; deaths, 82, in 1902.

Cholera.—None.

Smallpox.—None. Vaccination thorough this year.

Several cases sarna and herpes. Children suffer from malnutrition, and many younger die from inanition.

In 1901, 8,063 head of cattle died from rinderpest. There are no horses and but few carabao.

SAN NARCISO, TAYABAS.

San Narciso, six hours by trail from Mulanay, very rough. Many places almost impassable for horse. In rainy season trail is very bad. Hygienic and sanitary conditions naturally excellent. Water supply from mountain stream and wells. The wells furnish most of water for drinking purposes. Owing to dry season supply is scanty, but of good quality. All offal is removed to outskirts of town and thence burned weekly. No closets or sinks in town. At outskirts of town latrines and closets are erected for use of inhabitants.

Dysentery.—This town suffered from an epidemic of dysentery last year; was believed to come from bad well water. The presidente had wells thoroughly cleaned, and each Saturday they are dipped as dry as possible and great care taken to keep the water free from any contamination. A guard is detailed to watch each well at night. Since above measures were taken dysentery has disappeared. Tuberculosis cause of death in one-tenth of cases. Births, 105; deaths, 70.

Cholera.—Lasted about six weeks, 11 deaths in pueblo; 1 case in remote barrio, 16 miles away. Epidemic lasted from September 1 to October 17, 1902. Quarantine measures enforced. Bodies buried in lime. No funerals permitted.

Smallpox.—None. Vaccination not thorough, owing to lack of virus.

Measles.—An epidemic, but no deaths from this disease thus far.

Economic conditions fair. People are cleanly, industrious, and progressive.

In November, December, and January, 300 head horses died. Symptoms: Drooping of ears, refusal of food, and "sleepy." This condition is followed by appearance of great number of maggots discharged from nostrils; death in three or four days. In 1901, 7,000 head of cattle and 2,000 carabao died.

No board of health other than provisional. Municipal presidente, secretary, and practicante are acting. Meet monthly. Two members inspect pueblo and barrios weekly. Many fines were formerly collected, but few imposed now. The people are very anxious to learn English and desire an American teacher. Petroleum is reported in mountains near San Narciso.

REMARKS.

TAYABAS.

Communication between pueblos Sariaya, Tiaon, Tayabas, Luchan, and Pagbilao may be reached by carromata or horse from Lucena. Roads are good during dry, but bad during rainy seasons, though not impassable. A very rough and rocky trail from Luchan to Sampaloc, almost impassable for horse. From Sampaloc to Mauban road good. Lagamanoc and coast pueblos Unisan to Bondog best reached by boat. Trail from Lagamanoc to Antimonan, which is on Pacific coast, is rough, and in wet season very bad, owing to clay soil. From Antimonan to Calasag, via Gumaca and Lopez, trail is good for horse or pack train; fair for carromata. Bridges are greatly in need of repair, and in greater number of cases it is necessary to cross the stream on one or the other sides of road. From Lopez to Guinayangan a trail follows the telegraph line 29 miles, but is very rough, and in dry season drinking water is scarce. Better means of communication is Lopez via Calaoay; two-thirds of journey is in banca. In rainy season trail is very muddy. All roads are fair during dry season, but during rainy season many are impassable for mud.

Telegraphic communication with Lucena, Tayabas, Candelaria, Pagbilao, Antimonan, Gumaca (soon to be abandoned), Lopez, and Guinayangan. Telephone connects Pagbilao, Tayabas, and Sariaya, and lines in course of construction to connect all pueblos with capital at Lucena.

People are cleanly, industrious, and progressive. In all pueblos where United States army officers were stationed or assigned during the cholera epidemic the san-

itary conditions are superior to others, and the local authorities are very proud to state that they were taught by medico de militar. There is an order directing concentration of people in barrios or communities, and is being very generally complied with in this province. Good substantial houses are being erected in groups, and the people seem contented. Owing to vacation among teachers it is impossible to organize boards of health. In many cases the teachers will change pueblos at next term of school.

There is little leprosy or insanity in this portion of the province. A great majority, fully 80 per cent, of diseases is of malarial origin. Poor and scanty food, and early marriage of parents beget a feeble and puny creature that has but little power to resist inroads of disease. Scanty clothing, there being no change practically between that worn during the heat of midday and cool of midnight, and sleeping with but little, if any, protection from changes, lead to colds. No medicines are used to any extent. In most localities there are members of chinchona family and numerous vegetables and native remedies for many of the local complaints, and a very few possess a slight knowledge of medicinal properties of plants, but the average native is too lazy to exert force enough to prepare a simple infusion. It is too hard work to build a fire to boil the water or keep it boiling if all else is prepared. All are superstitious and believe in sorcery.

At present there is no president of provincial board of health.

Upon arrival of virus at Lucena, the local pueblos, Tayabas, Seriaya, Candelaria, Taon, Pagbilao, Sampaloc, and Lucban, were supplied. All coast towns and Marinduque should be supplied from Manila direct, as frequently boats do not leave Lucena for a week or more, and as there is no ice the virus will not keep, and by mail or courier the time required renders the virus inert. Marinduque's should be sent to Boac and distributed from that point; Alabat, Calaoag, Lopez, and Gumaca from Antimonan.

The entire province of Tayabas is suffering from loss of cattle and carabao in 1901. In the old province agricultural pursuits are almost abandoned; but very little rice is raised, as the soil can not be tilled. Hemp can not be prepared for want of carabao to transport to market. Where thousands of cattle were sold from island of Marinduque not a head is to be seen, and the very few carabao are poor. The season is remarkably dry and all rice and grain planted has been burned up, and a complete failure of crops leave the natives in straits. Each pueblo visited has been thoroughly inspected. The presidente, secretary, and practicante, or most useful member has been instructed in resanitary laws and directed how to prepare the register of births, marriages, and deaths. The padres, as a rule, are not opposed to the instruction of the children in sanitary matters. From the padre much valuable information may be obtained touching the health and sanitary conditions of pueblos, and they have interested themselves in promulgation of rules for cleanliness. The governor, secretary, and officers of the province have greatly assisted in the inspection and each recommendation has been carried out promptly.

The attitude of the natives shows great confidence in the present administration, and the province is rapidly advancing.

REPORT ON AMBOS CAMERINES, SUBMITTED TO THE BOARD OF HEALTH BY W. H. COOK, PROVINCIAL HEALTH INSPECTOR, DISTRICT D.

MANILA, P. I., May 15, 1903.

AMBOS CAMERINES.

NUEVA CACERES.

Nueva Cáceres, distant from Manila by water, four days. Population, 18,000; barrios, 18. Hygienic and sanitary conditions, good. Water supply, for domestic purposes, from river, mountain stream; greater portion used for drinking purposes from condensing plant and ice company. Offal is gathered in carts and taken to fields away from town and there burned. Malarial fevers, tertian form, predominate. Births, 446; deaths, 803, during 1902.

Cholera.—First case came from Manila. Epidemic lasted from April 1 to December 31, 1902; 219 cases, 142 deaths.

No disease among horses, cattle, or carabao at present, though imported carabao die. The provincial board of health requires all stock imported to be quarantined ten days if under a certificate from president of board of health, if existing, countersigned by president of district from which shipped. If without this certificate, all

stock is quarantined fifteen days. Should disease appear during quarantine an extension of fifteen days from date of last death is enforced.

Smallpox.—None. Vaccination thorough.

Dysentery.—None.

Tuberculosis.—Few cases of tuberculosis.

Early deaths among children due to malnutrition.

Municipal board of health organized and in good working order. Records well kept. Town well governed by sanitary board. There are three companies of infantry and two troops of cavalry stationed here, and the medical officers of army and civil work in perfect harmony. An excellent fraternal fellowship obtains.

People are cleanly, industrious, and progressive. English is well understood and spoken by a large per cent of population. Many modern establishments are here, and a paper published twice a week in the local Spanish and English languages is the greatest factor in interesting the native progression.

The provincial prison is at this station. It is in good sanitary condition, well cared for, and the discipline is excellent. About 5 miles from town, connected by fine road, is an institution, at present occupied by 32 lepers, dignified by the name of "leper hospital." This is a disgrace to civilization. The inmates are in a large barn-like building, in a poor condition, and with surroundings most depressing. Beds, made apparently by the individual, each differing from the other, and none with sufficient clothing, are arranged along the walls. The floors are sadly in need of repairs, as is the entire building. The inmates have no occupation, and consequently devote their time to wailing over their misfortunes and finding fault with a law that compels them to such captivity.

There is a great amount of public land near to and surrounding this place, and if these lepers were removed to the colony (?) at Culion, the buildings, with a few thousand dollars, could be made serviceable for an insane asylum for the provinces of Tayabas, Ambos Camarines, Albay, and Sorsogon, and the institution made nearly self-sustaining. The insane, or a great portion of them, could be given occupation by employing them on a farm on which could be raised produce sufficient to furnish food for all inmates.

RAGAY, CAMARINES.

Ragay, distant twenty-four hours by banca and trail from Nueva Cáceres. Population, 2,400; barrios, 10. Hygienic and sanitary conditions naturally good. Water supply, from rapid running mountain stream, ample and of good quality. Offal is removed or burned by each individual property owner. Malarial fevers predominate. Births, 50 in 1902; deaths, 175 in 1902.

Cholera came from Nueva Cáceres and lasted from July 24 to September 3, 1902; 18 deaths. Quarantine rules were enforced. Dead buried or interred in vicinity of death. Body covered with lime. Houses where disease occurred were burned.

Smallpox.—None. Vaccination thorough this year.

Causes of death, in 119 cases, malaria; 11 cases, tuberculosis, and 6 cases, beri-beri.

Economic conditions, poor. People are cleanly, industrious, and progressive.

Glanders exists among horses; 20 deaths from that disease this year. Cattle, 2,000 head, and same number of carabao, died in 1901 from "epizootic."

Provisional record of births and deaths. No board of health. The municipal presidente and secretary constitute a sanitary board and are doing good work. There is no practicante at this pueblo. An official register of births and deaths ordered.

LUPI, CAMARINES.

Lupi, distant twenty hours by banca from Nueva Cáceres. Population, 1,400; barrios, 8. Hygienic and sanitary conditions naturally good. No effort on part of municipal authorities to benefit sanitation. Water supply, from mountain stream, ample and of excellent quality. Births, 26; deaths, 14; 4 deaths over 70 years of age.

Cholera.—One case from Daet; body cremated.

Smallpox.—None. Vaccination thorough. Majority of illness due to malaria.

Economic conditions very poor. People lazy, indolent and dirty.

In 1901, 71 horses, 100 cattle, and 100 carabao died from "epizootic." Live stock practically exterminated.

No board of health. Register of births, marriages, and deaths well kept. This pueblo has a deserted appearance. Hard to find streets. Very few have a trail through them.

SPIOCOT.

Spiocot, distant two and one-half hours by banca from Lupi. Hygienic and sanitary conditions naturally good. Water for domestic purposes, from fine mountain stream, ample and of good quality. Population, 2,000; barrios, 9. Offal is burned. Births, 19; deaths, 24. Malarial fever cause of greater number of deaths.

Cholera.—No history of this disease.

Smallpox.—None, in Pueblo proper. Several cases in near barrio. The vaccinator and presidente are at barrio superintending thorough vaccination. One death on May 3. Pueblo is poor and has a deserted appearance, but little interest taken by officials.

Economic conditions poor. A great portion of people are suffering from malarial fever, tertian form. Municipality organized February 2, 1902, and records fairly kept since. No board of health. People cleanly, industrious, and progressive.

No disease among livestock at present. Nearly all cattle and horses died in 1901.

LIBMANAN.

Libmanan, distant three and one-half hours by banca from Spiocot. Hygienic and sanitary conditions good. Water for domestic purposes, from mountain stream, ample and of good quality. Population, 16,000; barrios, 6. Offal gathered and burned. Births, 660; deaths, 551.

Cholera.—From April 12 to May 19, 1902, 135 cases; 80 deaths. Recurred in December, 35 cases; 27 deaths. Came from Daet. Sick cared for by members of family and special natives employed by provincial board of health under the supervision of United States army medical officer. Dead were cremated at outset of epidemic, but later interred, covered with lime, buried near place of death. No funerals permitted. Quarantine rules enforced under direction of medical officer United States Army. Death of young children due to malnutrition.

Economic conditions, fair. Pueblo is declining. Many of the inhabitants are going to the mountains to plant rice. No live stock to cultivate the soil.

Board of health, none. The presidente and the secretary enforce the sanitary rules inaugurated by provisional board of health during epidemic. People are cleanly and industrious and progressive. A great many speak English sufficiently to transact business.

One hour's row upriver is a fine hot mineral spring, a specific for cutaneous diseases, and many visit this spring from neighboring pueblos and bathe in its waters. There is a fine quality of limestone here and a kiln is turning out some first-class lime. With little expenditure the capacity could be increased sufficiently to supply Nueva Cáceres. A sufficient supply can be secured for use of all pueblos above, or upriver, from this point.

CABUSAN.

Cabusan, a large barrio of Libmanan, two hours by river stream from Nueva Cáceres and two and a half hours from Libmanan. The town is low, but not sickly. Population, 2,000, mostly engaged in fishing. Water for domestic purposes obtained from shallow wells in coral formation; is very "brackish," and probably seepage from river mixed with sea water. Streets and houses are clean. Offal is carried to edge of town and burned.

Cholera.—There were 20 deaths here during fall months, though no report was had at the time.

Smallpox.—No cases. No vaccination thus far, though vaccinator reports having performed his duties, he has not even been in the barrio this year. See note in re "Vaccinators in Pueblos."

The people are cleanly and progressive, and many speak some English. All boats calling at Nueva Cáceres pass this barrio, and river boats between Nueva Cáceres and points as far up river as Lupi stop at this point. A great market for fish.

MAGARAO.

Magarao, distant four miles from Nueva Cáceres, by carromata; roads good. Sanitary and hygienic conditions good. Water, procured from spring, ample and of good quality. Offal is piled at outer edge of town and burned weekly. Population, 5,150; barrios, 16. Births, 126; deaths, 284. Malarial fevers, tertian form, and malnutrition of younger children cause greater number of deaths.

Cholera was introduced from Nueva Cáceres; lasted from April 18 to June 5; 324 cases, 249 deaths. Bodies were cremated. Houses where isolated were burned; a few were fumigated.

Smallpox.—No cases. Vaccination is thorough.

Dysentery.—A few cases.

Tuberculosis.—A few cases.

No disease among live stock at present.

Records are complete and well kept. A monthly report is rendered the last day of each month, giving deaths among all live stock and the cause.

At outset of epidemic about 70 deaths not reported, and no measures taken for prevention. The presidente was tried and suspended and present incumbent appointed, and stamped disease out in remarkably short time. A strong and useful presidente. United States medical officer directed local authorities during the epidemic of cholera. The presidente is very rigid in enforcing instructions regarding sanitation as prescribed by president of provincial board of health.

BOMBON.

Bombon, distant 6 miles from Nueva Cáceres; carromata; roads good. Population, 2,400; 1 barrio. Hygienic and sanitary conditions, good. Water supply, from mountain stream, ample and of good quality. Offal is carted out of town and burned. Births, 89; deaths, 174. Malarial fever cause of greater number of deaths.

Cholera was brought from Nueva Cáceres; 29 cases, 21 deaths. Sick were cared for by local police, under supervision of United States medical officer. Bodies cremated and houses burned.

Smallpox.—None. Vaccination thorough.

Dysentery.—No cases.

Tuberculosis.—Few cases.

Economic conditions fair. People cleanly, industrious, and progressive. No disease among live stock. No municipal board of health; directly under direction president provincial board of health. Records well kept.

QUIPAYO.

Quipayo, distant 7½ miles from Nueva Cáceres; carromata; roads good. Population, 1,500; barrios, 4. Hygienic and sanitary conditions fair. Water supply, from mountain stream, ample and of good quality. Offal carted out of town and burned. No record of births and deaths kept. Many cases malarial fever.

Cholera.—From Nueva Cáceres; lasting from April 18 to April 30; 8 cases, 6 deaths. Bodies cremated and houses burned. The sick were cared for by members of family, under direction of medical officer of United States Army.

Smallpox.—None. Vaccination thorough.

Dysentery.—None.

Tuberculosis.—Few cases.

Pueblo is poor and will be attached as a barrio to Calabanga. People are cleanly and progressive. Disease among live stock, none reported. No municipal board of health; provisional board acting directly under supervision of president of provincial board of health.

CALABANGA.

Calabanga, distant 10 miles from Nueva Cáceres, by carromata; roads good. Hygienic and sanitary conditions naturally good. Water supply, from mountain stream, ample and of good quality. Offal is carted out of town and burned. Population, 3,500; 1 barrio. Industries are fishing and hemp raising. Births, 158; deaths, 206; Malarial fevers, tertian form, cause of greater number of deaths.

Cholera came from Nueva Cáceres. Lasted from April 26 to June 8; 52 cases, 38 deaths. Sick cared for by members of family, under direction of medical officer, United States Army; dead were cremated.

Smallpox.—None. Vaccination thorough.

Dysentery.—None.

Tuberculosis.—Few cases.

Deaths of children, many cases due to malnutrition.

No disease at present among live stock. Economic conditions, poor. People are cleanly, industrious, and progressive. No municipal board of health. Under immediate direction of provisional board of health. Record of births and deaths kept fairly well. Instructed as to entering dates and keeping of records.

MILAOR.

Milaor, distant 2 miles from Nueva Cáceres. Transportation by horse; roads good. Hygienic conditions fair. Water supplied from mountain stream. Ample and of good quality. Population, 4,000; barrios, 7. Offal is carted out of town and burned. Births, 202; deaths, 336. Malarial fevers cause of great number of deaths.

Cholera came from Nueva Cáceres. Epidemic lasted from April 22 to May 6; 34 cases, 18 deaths. Sick were cared for by natives. Bodies were cremated.

Smallpox.—None. Vaccination thorough.

Dysentery.—None.

Tuberculosis accounts for 20 per cent of deaths in 1902.

Economic conditions poor. People are cleanly, industrious, and progressive. No disease among horses, cattle, or carabao. Provisional record of births and deaths. Instructed to obtain register and taught how to keep same. No local board of health. Under immediate direction of provincial board of health. Five cases leprosy here, living with families. No isolation. Principal industry, hemp raising.

MINALABAG.

Minalabag, distant, 2 miles from Milaor; carromata; roads good. Hygienic conditions fair. Water supply, from mountain stream, ample and of good quality. Population, 4,000; barrios, 9. Offal from town removed and burned. Births, 108; deaths, 144. Malarial fevers cause of greater number of deaths.

Cholera.—Thirty-nine cases, 25 deaths. Came from Nueva Cáceres, and lasted from April 19 to May 3. Sick cared for by members of families. Dead cremated. Greater number of infected houses burned. A few fumigated.

Smallpox.—None. Vaccination thorough.

Dysentery.—Few cases.

Tuberculosis.—Twenty-five per cent of deaths caused from this disease.

Malnutrition cause of large per cent of deaths among children.

Economic conditions fair. People cleanly, industrious, and progressive. Register of births and deaths well kept. No board of health. Directly under supervision of provincial board of health.

SAN FERNANDO.

San Fernando, distant 5 miles from Milaor, 7 miles from Nuevas Cáceres, by carromata or horse; roads good; bridges in bad condition. Hygienic and sanitary conditions bad. Streets in dirty condition. Presidente instructed as to cleaning his pueblo.

Water supply, from mountain stream, ample and of good quality. Population, 3,500; barrios, 11. Births, 106; deaths, 106. Malarial fevers, tertian form, prevail.

Cholera.—Fifty-seven cases, 28 deaths. Came from Nueva Cáceres, lasting from May 3 to 18. Sick were cared for by members of family. Dead buried in lime. A few cases were cremated.

Smallpox.—None. Vaccination thorough.

Dysentery.—None.

Tuberculosis the cause of about 10 per cent of deaths.

Economic conditions poor. People cleanly. No diseases among live stock at present. No municipal board of health. No regular register of births and deaths. Instructed to procure one and taught use of same. Principal industry, hemp raising.

PASACAO.

Pasacao, distant four hours from San Fernando, horseback; roads good; bridges are broken and can not be crossed. A trail for horse leads around these. In the wet season the streams are greatly swollen. Water for domestic purposes comes from two large mountain springs, one at either side of pueblo. Either stream is more than equal to supply; the water cool and of excellent quality. A small pool around the spring is emptied over a small bank about two feet high. Below this the people bathe and use this water, which is very soft, for washing. Population, 2,000; barrios, 8. Births, 59; deaths, 42. Malarial fevers in tertian form.

Cholera.—Twelve cases, 10 deaths. The first case came from San Fernando; epidemic lasted from June 26 to July 23. During entire epidemic of cholera, a provincial inspector visited all incoming boats.

Smallpox.—None. Vaccination thorough.

Dysentery.—None.

Tuberculosis.—Few cases.

No diseases among live stock. No municipal board of health. Presidente a strong man and most of his councillors are superior men. Under immediate direction provincial board of health.

About one hour's ride by banca, near the coast, is a large hot mineral spring. A specific for rheumatic complaints. A large number of springs in the locality, many of tonic and recuperative properties.

The pueblo is exceptionally clean and indicates a good economic condition. Natives are cleanly, industrious, and very progressive. A great many natives of interior pueblos come here for bathing, both in the sea and hot mineral springs. Fishing is quite an industry.

Within an hour's ride an elevation of about a thousand feet can be reached. A good road could be made by expenditure of a small amount upon bridges and slight ditching to connect Nueva Cáceres, and two and a half to three days' time saved between the pueblo and Manila, doing away with the passage through Bernardino Straits. But little would be required, \$100,000, to build and equip a railroad between these pueblos that would soon become cities. A good road connects this place with Nueva Cáceres, via Pamplona, by land and thence river.

PAMPLONA.

Pamplona, distant three hours from Pasacao by horse. Hygienic and sanitary conditions good. Roads good. Few bad bridges. Population, 4,000; barrios, 8.

Cholera.—Introduced from Nueva Cáceres April 28, 1902. Two cases; 2 deaths. Bodies cremated and houses burned.

Smallpox.—None. Vaccination thorough.

Malarial fevers predominate. No register of births or deaths. Secretary directed to procure one and instructed in use of same. Natives cleanly, industrious, and progressive. No disease among live stock. No board of health. Under immediate supervision of provincial board of health. Principal industry, hemp raising.

DAET.

Daet, distant twelve hours by boat from Nueva Cáceres; 4 miles inland. Roads good in dry season, very bad in rainy season. Hygienic and sanitary conditions excellent. Population, 13,515; barrios, 11. Water supply, from mountain stream, ample and of good quality. Offal hauled out of town and burned. Births, 675; deaths, 580.

Cholera from Manila during month of December, 117 cases; 69 deaths. Bodies were cremated at beginning of epidemic; later interred in lime. Sick cared for by practicante and members of families under direction of member of hospital corps and medical officer of the United States Army. Rigid quarantine rules enforced. Extra police patrol.

Smallpox.—No cases at present; 2 cases, 1 death, in March. Vaccination thorough.

Dysentery.—Few cases.

Tuberculosis.—Eighty-five cases during last year.

Malnutrition the cause of death of majority of young children. No disease among stock at present.

Economic conditions excellent; 16,000 pesos in municipal treasury. People are cleanly, industrious, and very progressive. Appearance of prosperity on all sides. Municipal board of health organized and in fine working order. Records well kept. No public register of births and deaths, except provisional register, ordered. Each street in town well lighted. Lamps are clean, on posts of equal height and equidistant. A model and modern city. Shipping point of all hemp raised in vicinity.

SAN VICENTE.

San Vicente, distant two hours' drive by carromata. Roads good in dry season, very bad in rainy. Hygienic and sanitary conditions good. Water supply, from mountain stream, ample and of good quality. Offal carted out of town and burned. Malarial fevers predominate, tertian form. Births, 91; deaths, 120, in 1902, mostly from calentura.

Cholera.—No cases (?) reported.

Smallpox.—Ten cases, 8 deaths from smallpox during month of April, 1903. Vaccination thorough; this year's work just completed.

Dysentery.—Very few cases.

Tuberculosis is the cause of 10 per cent of deaths.

Beriberi.—In 1902, after the season of calentura, January to June, there were a number of cases of beriberi.

Malnutrition is found among infants. No diseases among horses or cattle at present. A form of "hoof rot" has lately appeared among carabao.

Economic conditions good; 1,400 pesos in treasury. No municipal board of health organized. No register of births and deaths. Register ordered. One horse in entire pueblo.

LABO.

Labo, distant two and one-half hours by trail from San Vicente. Trail fair in dry season, but very bad in rainy season. Hygienic and sanitary conditions good. Water supply from river, a fine stream 9 feet deep in main channel. Population, 5,000; barrios, 8. Offal carted out of pueblo and burned weekly. Births, 148; deaths, 265. Malarial fevers cause of greater number of deaths. During the season of fevers, from January to June, beriberi prevails as a sequel to malarial fevers.

Cholera.—No cases reported.

Smallpox.—Twenty-six cases of smallpox last year. Vaccination thorough.

Dysentery.—Few cases.

Tuberculosis.—Eight cases.

A great number of deaths among infants due to malnutrition and malarial fevers. Economic conditions fair. Natives are cleanly, industrious, and progressive. In 1902, 400 horses, all cattle, and 190 carabao died from rinderpest. No municipal board organized. Records kept in provisional register; new register ordered; large. A large amount of hemp is produced, but owing to lack of carabao transportation is very difficult.

TALISAY.

Talisay, distant two and one-half hours' ride from Labo, horseback; one-half hour from Daet. Roads between Labo and Talisay very badly cut by carts. The soil is of clay formation, and in rainy season almost impassable. All bridges are broken or washed away. Hygienic and sanitary conditions fair. Offal is carted out of town and burned. Water supply, from mountain stream, ample and of good quality. Population, 3,400; barrios, 15. Births, 270; deaths, 400. Malarial fevers cause of great number of deaths, ordinarily.

Cholera.—Introduced from Daet; 125 deaths. Epidemic lasted during the months of November and December. Three deaths from cholera in January. Earlier cases, bodies were burned, but later interred in lime near place of death. Sick cared for by natives under direction of the United States Army officer and members of hospital corps.

Smallpox.—Eight cases; 5 died during the month of April, 1903. Vaccination thorough.

Dysentery.—Few cases.

Tuberculosis.—Few cases.

Beriberi is of frequent occurrence following attack of malarial fever, tertian.

Many young children die from malarial fever and malnutrition.

Economic conditions good. People are cleanly and progressive. No municipal board; provisional register; a new register ordered.

INDAN.

Indan, distant one hour's ride from Daet. Hygienic conditions poor; roads good; population, 6,000; barrios, 8. This is a very sickly locality, malarial fevers, tertian form, prevailing. Headquarters of constabulary, 13 out of 20 members were on sick report; one died after very brief illness, cause unknown. Economic conditions poor. Unable to obtain data in re births and deaths as well, as all records are in hands of expert pending investigation. All officers are at Daet, and treasurer suspended pending result of investigation; vice-president has been ordered to capital. The natives are cleanly and progressive; English is spoken by a great many.

BASUD.

Basud, distant about 2 miles from Daet, will be annexed to that pueblo shortly, and will be directly under supervision of board of health of that pueblo. Unable to gather data, as all records are in Daet, pending an investigation and annexation to that pueblo.

BAAO.

Baao, distant 20 miles from Nueva Cáceres, by horse or carromata; roads excellent; hygienic and sanitary conditions good; water supply from mountain springs and

river, ample and of good quality; offal carted out of town and burned; population, 8,000; barrios, 9; births, 414; deaths, 247; malarial fevers, tertian form, predominate.

Cholera.—Seventy-seven cases; introduced from Nueva Cáceres. Epidemic lasted from April 26 to October 15. Deaths, 49. Isolated cases continue to appear, mainly in distant barrios. There have been 34 deaths up to April 25, 1903. A few cases are reported near Nabuna and Irega at haciendas of Spaniards, but close inquiry fails to locate accurately or definitely. Sick cared for and quarantine measures carried out under direction of medical officer, United States Army, detailed by commanding officer at Nueva Cáceres to assist civil authorities.

Smallpox.—None. Vaccination thorough.

A large number of cases of dysentery.

Tuberculosis.—One-seventh of the deaths is caused from this disease. Disease among live stock, none. Economic conditions poor. No municipal board of health. Register of births and deaths, provisionally, fairly kept. A new register ordered and secretary instructed in use of same. Habits of people cleanly; intelligent and progressive. Three cases of leprosy at this pueblo, living with their families. Hemp-raising district.

IRIGA.

Iriga, distant 24 miles from Nueva Cáceres by horse. Roads excellent. Hygienic and sanitary conditions excellent. Population, 19,338; barrios, 11. Water supply, from springs, ample and of good quality; running water in canal through main streets. Offal is carted out of town daily and burned. The market is opened in the late afternoon and closed at 10 p. m. Afterwards the ground is cleaned, and no trace of market is visible by 6 a. m. Many cases of malarial fever. Births, 940; deaths, 547.

Cholera.—Forty-eight deaths from local report, while report at provincial board shows 31 cases and 21 deaths. Cholera introduced from Nueva Cáceres; epidemic lasted from September 22 to October 31. Quarantine measures adopted, and bodies cremated under direction of medical officer of the United States Army.

Smallpox.—None. Vaccination thorough.

Dysentery and tuberculosis.—Rare.

Leprosy.—Ten cases known to be living with their families in this pueblo.

Asthma.—A large number of cases among the natives at this pueblo.

Economic conditions excellent. Municipal board of health. Provisional register births and deaths kept. Regular register ordered. Nearly all live stock has died the past two years. The pueblo is clean and well kept. A new tribunal building is nearing completion. The people are cleanly, industrious, and progressive, and on every hand indications of prosperity. The population is rapidly increasing. About 3,000 added to the population during past year from neighboring and less prosperous pueblos. This is a hemp-raising district. A few fine carabao and horses are to be seen at this station. At one time this locality was famous for its ponies.

BUHI.

Buhi, distant 9 miles from Iriga; roads excellent. Hygienic and sanitary conditions good. Water supply, from lake, streams, and wells, ample and of good quality. Population, 7,500; barrios, 13. Births, 439; no record of deaths. Many cases malarial fever.

Cholera.—Introduced from Albay, lasted from August 24 to September 6. Official report, local statements and records conflict. Many cases not reported. This is the terminus of road, and a trail leads into Albay Province, and many cases of cholera came from that district. From provincial records there were 57 cases and 44 deaths, while local reports show 94 deaths. In April, 1903, owing to ladrones entering this province from Albay, over trail above referred to, the natives flocked to pueblo. Immediately a new outbreak of cholera appeared, and isolated cases continue to appear. Of 94 cases reported this year to April 30, 49 cases were natives of Buhi. Cholera still exists in Albay, near this line, and is communicated from that locality.

Smallpox.—None. Vaccination is thorough.

Dysentery.—There are a few cases.

Tuberculosis.—Ten per cent of deaths are from this disease.

Measles are epidemic at present, though very few deaths from that disease.

Leprosy.—Six cases of leprosy living with families.

No municipal board of health exists. No register of births and deaths. Official register ordered and secretary instructed in use of same. Economic conditions poor. The practicante instructed to report weekly to provincial health board. The people are not as progressive as in other pueblos. No disease among live stock. Principal industry, hemp raising.

NABUA.

Nabua, distant 3 miles from Iriga; roads excellent. Hygienic and sanitary conditions good. Water supply, from wells about 15 feet in depth, ample and of good quality. Offal from town burned. Population, 18,902; barrios, 16. Births, 749; deaths, 855.

Cholera came from Nueva Cáceres, lasting from April 10 to November 30; 197 cases, 173 deaths. At outset of epidemic bodies were cremated; later they may be interred in lime.

Smallpox.—Few cases; 3 cases and 1 death in the month of April, 1903. Vaccination thorough.

Dysentery.—None.

Tuberculosis.—Few cases.

Leprosy.—Twelve cases of leprosy at this pueblo. No efforts at isolation.

Economic conditions fair. Provisional birth and death register. Official register ordered and secretary instructed. No municipal board of health. Presidente recently resigned; vice-presidente acting and doing good work. People cleanly and progressive. No disease among live stock. All industries at a standstill.

BATO.

Bato, distant 4 miles from Nabua; roads good; sixteen hours by boat from Nueva Cáceres. Population, 4,200; barrios, 4. Hygienic and sanitary conditions fair. Water supply for domestic purposes taken from lake. Ample and of good quality when taken some distance from shore, but native prefers getting it near shore. This lake is means of transportation via Banca to Albay Province, about three hours' rowing. No regulation as to disposition of offal. Births, 266; deaths, 146. Malarial fever cause of one-fourth the number of deaths.

Cholera was introduced from Nueva Cáceres; epidemic lasted from April 25 to October 5; 26 cases, 24 deaths. Bodies were interred in lime. Quarantine rules enforced partially. The presidente is a poor stick and the pueblo indicates that fact.

Smallpox.—None. Vaccination is thorough.

Dysentery.—None.

Tuberculosis.—Thirty deaths during past year. Provisional records poorly kept. Register of births and deaths ordered and secretary instructed.

Economic conditions poor.

REMARKS.

The president of provincial board of health accompanied and greatly assisted in securing data, and took the opportunity to pretty thoroughly lecture some of the local members of council, and has sent each secretary a communication requiring acknowledgment, asking information, and directing a report of each pueblo at end of each month.

Cholera.—No cases. There is no question but a large number—in some localities 30 per cent of cases and deaths—were not reported. When cremation was resorted to, the natives to avoid this did not report. Many dead were buried at night near place of death. In some cases near Libmanan the dead were buried under the houses.

In vaccination, the provincial president of board of health favors a vaccinator for a district who shall also act as health inspector. This individual should be under the direct charge of the provincial board of health. It has proven the better plan where the vaccinator is directly under the supervision of provincial president of the board of health.

A monthly report of all diseases among live stock is to be sent in as a part of the sanitary report. The inclosed is a sample of report required at present.

This province is suffering greatly from loss of horses, cattle, and carabao. Fully 95 per cent have died in the past two years. Large tracts of land are uncultivated, and much hemp can not be marketed owing to need of carabao.

Fishing is a leading industry.

The presidents of various pueblos meet at capital once every three months, and at this meeting the provincial president of the board of health instructs them in sanitary measures. As a result, there is a uniform government in each pueblo. Nearly all of the pueblos in this province have been visited and inspected by the provincial president of the board of health, and the good results are to be seen on all sides. Under present conditions the entire province is under his direct control, and the governor is expediting matters by holding municipal authorities to their work. Many pueblos unable to manage their districts are being annexed to more progressive

ones, thereby losing their identity, and this is having the effect to stimulate the inhabitants to some exertion. As a rule, the native must have constant urging and watching. Once having performed a duty, he assumes his object in life has been accomplished. To make a success of native administration, there must be eternal vigilance on the part of the proper authorities or backsliding will result, and once started an avalanche follows, and the Filipinos are disposed to retrograde rather than advance.

In the provinces of Tayabas and Camarines, so far as visited, and in the pueblos and their barrios but little cockfighting obtains. Many men are to be seen at work, and there is but little gambling.

In many pueblos the native must show some occupation or visible means of support or be fined, and the fine "worked out" on the streets in most cases.

Respectfully submitted.

W. H. COOK,

Provincial Health Inspector, District D.

THE COMMISSIONER OF PUBLIC HEALTH,
Manila, P. I.

REPORT OF SANITARY CONDITIONS IN THE PROVINCES OF RIZAL, LAGUNA, CAVITE, AND BATANGAS, BY DR. L. A. B. STREET, SPECIAL MEDICAL INSPECTOR.

SIR: In compliance with Special Orders, No. 22, dated from your office February 20, 1903, I have the honor to submit the following brief report of conditions as found in the provinces of Rizal, Laguna, Cavite, and Batangas.

PROVINCE OF RIZAL.

Total number of cases of cholera which occurred between April 1, 1902, and January 4, 1903:

Cases	2, 996
Deaths	1, 941
Mortality	64. 7

The first town in the province to be afflicted with cholera was Navotas, the disease introduced from Manila April 1, 1902. Malabon, Pasig, Binangonan, Angono, and Pateros became infected in the order enumerated, after which the disease became general throughout the province.

Here, as in Manila, the medium of infection was not understood, and consequently the work of extermination was difficult. The provincial board of health, however, responding to the instructions issued from your office, established provincial hospitals, and the care of the sick and the disposal of the dead were placed in the hands of a committee appointed by the president of the provincial board of health. Detention camps were also established and inspections made and disinfection carried out wherever it became necessary.

The dead were buried in quicklime one-half to 1 mile from the water supply.

Smallpox.—Deaths as per Exhibit A, 64.

At present there are a few sporadic cases throughout the province.

Dysentery.—Deaths as per Exhibit A, 47.

Typhoid fever.—Deaths as per Exhibit A, 3.

Lepers.—Number of lepers (see Exhibit B), 75.

Measles.—A few sporadic cases. A circular issued advising the necessary precautions.

Dengue.—General and benign.

Bubonic plague.—No cases.

Infantile convulsions.—Next in importance, on account of the tremendous mortality, comes infantile convulsions. The total number of deaths reported from this cause alone amounts to over 54 per cent of deaths from all causes.

Skin diseases.—Skin diseases are prevalent. Dermatitis, herpetiformis, and pemphigus are especially common. Seborrhœa, lichen scrofulosus, and psoriasis are also found in addition to the various parasitic affections.

In this connection my attention was especially drawn to a peculiar skin disease affecting the natives in the town of Pateros, and which, in view of the industry peculiar to that locality (namely, the raising of ducks), merits investigation. Doctor Angeles describes it in his report under the heading of "Frambesia," but I am of the opinion that it properly comes under the classification of parasitic skin affections.

I should be glad of the opportunity to investigate this disease further.

DISEASES OF ANIMALS.

Rinderpest.—Mortality between the years of 1897 and 1903, 90 per cent. No cases are being reported at present.

Surra.—No cases being reported.

"Peste en los cerdos."—From the character of this disease Doctor Angeles calls attention to the possible relationship to cholera. He says there is vomiting and retention of urine and death occurring very quickly. Certainly from the habits of these animals there is an excellent opportunity for bacterial infection, and it is only a question of natural immunity to certain forms of infection as to whether or not hogs are immune to the comma bacillus. I am not informed; should judge, however, that they are not.

"Peste de gallinas."—A diarrheal disease coincident with the cholera epidemic.

GENERAL REMARKS AND RECOMMENDATIONS.

In the interior of the province there are numerous springs which supply good drinking water. Near the Pasig River, however, the water is poor, particularly at Pateros. At Malabon, Navotas, Parañaque, San Pinas, etc., the water is brackish. Drainage poor, but no public funds to improve it. Malabon alone has a good market.

It is very hard to regulate the cemeteries, an important feature of sanitation, as most of them are the property of the church and are in some cases not sufficiently distant from the settlements. However, the provincial board of health is gradually adjusting this matter, and in the recent epidemic controlled the situation fairly well.

In view of the fact that Manila derives her water supply from the Mariquina Valley, we should require an ideal sanitary condition of that valley. As I did not follow the river above Montalban I take the liberty of inclosing an article by Doctor Angeles entitled "Sources of Manila's water supply," and marked "Exhibit C." This paper is self-explanatory.

1. Office of provincial board of health at San Mateo.
2. President of provincial board of health has one assistant, whom he pays out of his own pocket.
3. Orders and instructions are issued to the different towns, but, owing to the inefficient service and lack of cooperation on the part of the authorities, it is difficult to have them obeyed.
4. Recommend that carromatas be permitted to cross river below pumping station, as there is no danger of infecting the Manila water supply at this point, and the custom of issuing passes is, I think, unnecessary and an inconvenience both to the people and the military authorities.
5. It would be well to have the provincial superintendent of schools and president of the provincial board of health members of the provincial board.
6. A need of municipal physicians and municipal drug stores.
7. No provincial hospital. (See communications from Doctor Angeles, dated December 22, 1902.)
8. At present there are between 50 and 60 insane persons in the province, 15 of whom are more or less dangerous to the public welfare.
9. The druggist at the town of Mariquina informed me that there is a mineral spring near the town supposed to contain iron, and at Pasig I was shown a bottle of water brought from a sulphur spring near that town. Did not visit either, but requested that specimens be sent to Manila for analysis.
10. The provincial jail only provisional and the sanitary conditions poor.

PROVINCE OF LAGUNA.

There is no data relating to the cholera epidemic in this province prior to September 28, 1902, as it was only at this time that the civil government established a board of health. From that date to the present time there have been recorded but 24 cases, with 16 deaths. For the particulars of the epidemic, through the courtesy of Surgeon Major Woodruff, U. S. Army, I was enabled to refer to a report of his covering its entire history, abstracts of which report will be referred to later.

Smallpox.—Exists in the province in a mild form, and does not present any unusual characteristics. Beyond the vaccination of contacts there is little being done.

Measles.—Exists in a mild form.

Typhoid fever.—A few sporadic cases have been reported.

Dysentery and tuberculosis.—Beyond the deaths reported it is impossible to obtain any information, as the majority of cases are not under treatment.

Leprosy.—Number of lepers. Figures not received.

Malaria and its consequences in this province, as in the others, claim a large percentage of the mortality.

Appended you will find a report (marked "Exhibit D") which I obtained from the president of the provincial board of health giving a résumé of the existing conditions.

Water supply.—The question of the water supply throughout the province is an important one, the majority of the people obtaining their supply from the contaminated river water and from surface wells. The mountain towns are better off on account of the natural springs. It is worth while noting that wherever possible the mountain towns have running water in canals on the streets, and that subcanals are used to flush the water-closets and pigpens, the filthy water later finding its way back to the rivers, supplying the lower towns with water that is far from being either clean or safe. Majayjay, Magdalena, and San Pablo are illustrations of this method of keeping one town clean at the expense of the health of another.

Mineral springs.—A fine spring with bath house, Baño de Bonbongan, is located in Pagsanjan. It was built in 1897 by the town and is visited by people from all parts of the province. It is supposed to have medicinal virtues. Most probably it contains the magnesium salts, but not in any appreciable quantity.

Galas baths, situated across the lake from Santa Cruz in a barrio of Pangil. They are at present in ruins, but were used by the Spanish Government as a sanitarium for those affected with skin diseases. The supply of water is very small, and apparently the active principle is a weak hydrogen sulphide. Temperature, 78° to 80° F.

Relative to Los Baños much could be said, but I am aware that your office has complete data on the famed baths, which form the main attraction of this very small settlement.

Some distance from Calauan there is a natural sulphur and iron spring with an abundant supply of water.

At Pilar there is a spring which supplies excellent water, but beyond this there are few of the lowland towns the water of which is not exceedingly bad.

DISEASES AMONG ANIMALS.

At present there is very little disease among the animals, but during the past year there was a mortality of about 75 per cent from rinderpest alone. It is very difficult to obtain data, as the natives hide the cases.

REMARKS.

1. Found the provincial jail in exceedingly unsanitary condition.
2. President of municipal board of health, who also acts as physician to the provincial jail, is quite incompetent; but, in view of the fact that there was no other physician to appoint in his place, took no action. The government officials, however, are very much dissatisfied with his services, particularly the treasurer and supervisor of this province, their complaint being that the expense of maintaining the prison hospital is out of proportion to the number of inmates. On investigation, I found that the doctor was in the habit of prescribing expensive proprietary remedies. I called his attention to the matter and advised him to change this practice.
3. In view of the importance of this capital, beg to recommend a more competent medical man for the position of municipal and jail physician.
4. Town of Santa Cruz exceedingly low and without drainage. The river water, already contaminated, is here used for all purposes, from bathing animals to washing clothes and for drinking. It is very difficult to persuade the people to boil the water for drinking purposes.
5. At Los Baños, due to the fact that venereal cases come here from Manila for treatment, there is a large percentage of venereal disease among the native women. The cause is obvious.

Lieutenant and Assistant Surgeon Koerper, U. S. Army, tells me that over 80 per cent of the sickness among the soldiers is due to these diseases and that the situation is alarming. Doctor McVean, who is in practice at Los Baños, coincides with this opinion.

At Calamba there is also a good deal of venereal disease, but the situation is not as grave.

6. See inclosed table marked "Exhibit E." This table gives a partial list of deaths from all causes in the towns enumerated for the month of March.

PROVINCE OF CAVITE.

The first case of cholera was introduced into Cavite from Manila, the second case occurred in Bacoor; San Roque and La Caridad were next attacked, and from these towns the disease became general throughout the province. Isolation of patients

was practiced and detention camps were established. Nurses volunteered to care for the sick, and the several measures, preventive and otherwise, are reported to have been adopted, the efficacy of which were only limited by the lack of knowledge of cause and effect on the part of those who attempted to carry them out.

The report of the president of the provincial board of health, dated September 5, 1902, has covered the ground very thoroughly, and I shall only refer to a few special notes made during my inspection.

Deaths which occurred in Cavite, San Roque, and La Caridad, during the nine months ending March 31, from epidemic diseases were as follows:

	Cases.
Typhoid fever	7
Dysentery	35
Cholera, Asiatic	55
Smallpox	3

The number of cases of cholera for the province, as per report of Doctor Ejercito, dated September 5, 1892, were 1,897 cases with 1,086 deaths.

Number of cases of smallpox, as per report of 1902, were 506 cases with 130 deaths. At present sporadic cases are occurring throughout the province, and in Rosario, Naic, and Maragondon there are a large number of cases, which is no doubt due to the lack of precautions taken by the health authorities in the towns. In Rosario it was necessary to request the appointment of Victoriano del Rosario in place of Lue-rino Valenzuela, the latter having so flagrantly disregarded the ordinary rules of hygiene, and because of his failure to take any precautions against the spread of smallpox in his town. Here, as elsewhere, the old adage that familiarity breeds contempt is clearly demonstrated, and the unfortunate part of it is that under existing conditions there is so little that we can do beyond vaccination, and even this preventive measure, in the hands of the natives, is frequently ineffective.

Leprosy.—Number of cases reported, 19. This does not, however, represent all the cases, as many towns have not rendered their returns.

In regard to dysentery and tuberculosis, am unable to give figures. The principal diseases of the province are tuberculosis, dysentery, and malaria.

DISEASES OF ANIMALS.

Rinderpest and foot-and-mouth diseases are prevalent in Naic and Maragondon.

Rinderpest:	
Cases	206
Deaths	192
Foot-and-mouth disease:	
Cases	161
Deaths	131

See attached telegram, marked "Exhibit F."

REMARKS.

1. Provincial jail, two rooms under building occupied by provincial treasurer and supervisor of province. Both unsanitary and inadequate for the purpose.
2. Crematory built by military authorities, too small for its purpose.
3. No public slaughterhouse, the one in use being owned by a Chinaman. This building is in an unsanitary condition.
4. An available building for hospital purposes, provided the province can make its title clear.
5. Question of ownership of site of former market place and present market in an undesirable locality.
6. Province in debt.

PROVINCE OF BATANGAS.

The total number of cases of cholera in province, 13,457, with a death rate of 9,820 (a mortality of 72.97 per cent). It is questionable if these figures are correct, but there is no way in which they can be verified.

As there was no provincial board of health prior to July of 1902, I was obliged to refer to a report of Major-Surgeon Woodruff, U. S. Army, heretofore mentioned, for the necessary data, and as this report included the provinces of Laguna and Cavite as well as Bantangas, it will be as well for me to treat the subject in the same way.

From this report I find that the first case of cholera was introduced into Binan, Laguna, by a Chino, who smuggled infected food for a fiesta, and it is most probable that he, as well as others, became infected before leaving Manila.

The first cases reported (June 5, 1902,) as occurring at Dasmarinas, Cavite, were among the constabulary, who were said to have become infected at the barrio of Palaparan, 8 miles away.

In San Pablo, Laguna, the first case was that of a native who had visited Santa Cruz, where the disease had been epidemic for nearly two months. The next two cases occurred in the same street below the house of original case. An interesting point is the fact that the public gutters in this town have running water, which serves many purposes, and an American living near where these cases occurred informed me that he had seen people taking water from the gutter, ostensibly for drinking, and it is very common, indeed, to see the people washing dishes and clothes and even bathing in the same place.

At Majayay a cook of Company I of the Eighth Infantry was accustomed to eat raw beef which was transported through an infected country on a boat in which natives had died of cholera. This may or may not have been the exciting cause.

The first cases at Santa Cruz of which anything is known occurred in the prison and were supposed to have resulted from infected food introduced by natives.

The many cases which occurred among the American troops at Pagsanjan may have been influenced by the water which was brought from a spring by natives in bancas, and which is reported as not having been boiled.

The first cases at Lipa, Batangas, occurred in shacks scattered along a stream running through the town, and within forty-eight hours the infection of the water supply was general.

At Balayan, Batangas, the epidemic was almost exclusively confined to people in a part of the town using river water infected by the first case, the natives using spring water escaping.

In some cases the epidemic was traced to a particular well in a town. After the first cases were introduced, either through lack of quarantine or because of the facility with which the natives could evade the quarantine, the epidemic became general. The natives are frequently so ignorant and their family ties are so strong that it is impossible to obtain information of statistical value.

Smallpox.—Cases sporadic and mild. Unable to obtain number of deaths.

Leprosy.—Cases reported, 10.

Malaria and malarial cachexia are so common in this province as to assume the character of an epidemic disease, but it is impossible to give any figures.

DISEASES OF ANIMALS.

Rinderpest exists in Lipa, Ibaan, and Tysan.

REMARKS.

1. The provincial jail is the best and most sanitary building for the purpose I have seen.

2. The town of Lipa, with 46 barrios and a population of 32,324, has as president of the municipal board of health a graduate of the University of Santo Tomás, at a salary of 50 pesos a month, which salary the town has never been able to pay. This man is without any assistance whatever, and would be unable to cope single handed with epidemic disease should it occur. What is true here applies everywhere in the province. Many of the towns are too poor to even pay the regular officials.

In conclusion, permit me to draw your attention to a letter from the supervisor of Batangas Province, which is marked "Exhibit G." This letter is the result of a talk with me relative to the duties and responsibilities of provincial boards of health. This gentleman is qualified to make these statements, as he has come very closely in touch with sanitary matters.

Respectfully,

LIONEL A. B. STREET, M. D.,
Medical Inspector, Insular Board of Health.

The COMMISSIONER OF PUBLIC HEALTH,
Manila, P. I.

ADDITIONAL NOTE.—Since writing the above report I have obtained the following figures relating to the cholera epidemic in Santa Cruz for last year:

Number of cases.....	633
Deaths	416

EXHIBIT A.

This table is made up from reports from the towns of Binangonan, Cavite, Taytay, Pilalla, Inisao, Talajala, Montalbon, San Mateo, Pasay, Pasig, San Felipe Nery, San Juan del Monte, Malabon, Tanay, and Navotas.

Causes of death occurring between July 1, 1902, and March 31, 1903 (stillbirths and Asiatic cholera not included).

Cause of death.	Adults.		Children.		Total.		Medical assist- ance.	
	Male.	Fe- male.	Male.	Fe- male.	Male.	Fe- male.	With.	With- out.
Typhoid fever	4	3	1	2	5	5	3	7
Intermittent fever and malarial cachexia.....	94	78	17	13	111	91	7	195
Smallpox			33	31	33	31	2	62
Grippe	2	8	2	1	4	9	1	12
Dysentery	24	16	28	19	52	35	9	78
Erysipelas			1	2	1	2		3
Beriberi	21	20	3	2	24	22	1	45
Purulent infection and septicemia	1			1	1	1		2
Tuberculosis (unspecified).....	89	91	11	10	100	101	8	193
White swellings	1				1			1
Anemia	3	7	1	3	4	10	2	12
Meningitis	1		11	9	12	9		21
Cerebral congestion and hemorrhage.....	19	17			19	17	1	35
Paralysis without apparent cause.....	3	5			3	5		8
Infantile convulsions.....			262	270	262	270		532
Affections of circulatory system	22	31	2	1	24	32	1	55
Bronchitis, acute and chronic	29	22	15	17	44	39	2	81
Enteritis, acute and chronic	25	23	29	27	54	50	2	102
Hernia	1				1			1
Nephritis	3	1			3	1		4
Accidents of pregnancy		4				4		4
Puerperal hemorrhage		3				3		3
Senile debility	9	12			9	12		21
Traumatism	1				1			1
Dropsy (cause not defined).....	7	5			7	5		12
Tetanus	2		1		3			3
Unspecified	349	326	350	336	699	662		1,361
Total.....	710	672	767	744	1,477	1,416	39	2,854

EXHIBIT B.

PROVINCIAL GOVERNMENT OF RIZAL,
OFFICE OF THE PRESIDENT BOARD OF HEALTH,
Pasig, P. I., March 17, 1903.

Number of lepers living in the various towns of the province of Rizal, P. I.

Towns.	Num- ber of men.	Num- ber of wo- men.	Children and young.		Single.		Married.		Wid- owers.	Wid- ows.	Total.
			M.	F.	M.	F.	M.	F.			
Angono	1	3		1			1			2	4
Antipolo	3	3			1	2	2	1			6
Baras	3				2		1				3
Cardona	5	3			3	2	2	1			8
Caloocan	1				1						1
Montalban	6	2			3		2	1	1	1	8
Morong	2				1		1				2
Pasig	5				2		2		1		5
Pateros	3	1	1			1	2				4
San Mateo	2	2			1	1	1	1	1		4
Taguig	4	2			1	2	3				6
Taytay	8	4			3	3	5	1			12
Tambobong	3	1				1	2		1		4
Tanay	5	3			4	1	1	1		1	8
Total	51	24	1	1	21	13	25	6	4	4	75

EXHIBIT C.

SOURCES OF MANILA'S WATER SUPPLY.

The water supply for the city of Manila has its origin in a mountain, name unknown, east of Montalban, nearer to Infanta district than to Montalban. The natives who have talked with those who are well acquainted with the streams in the mountains say that the source of the river is about fifteen days' travel from Montalban.

From the same mountain source begins another stream, which flows to Angat and Norzagaray, both in Bulacan Province.

The stream flowing toward Montalban is very small near its source, but it receives the water from several branches in the various points where the river passes, some of which are larger than the principal stream, the more important being, from its origin, the following: Lumutan (name comes from the fact that rain falls throughout the year and the trees are always green), Sare or Tapusi (popular name since immemorial times as an inaccessible den of ladrones), Uyungan, Dumiri, Taladoy, Tayabasan, Bunbunan, Astampa, Kal, Kayrupa (where a larger stream enters), Kaykaro, and then the caves, distant about $3\frac{1}{2}$ miles from Montalban, at which point the river passes between two mountains, forming the caves. Many people think these caves are the origin of the river, but in fact only one small stream issues from one of the caves. The mountains here form a narrow defile, with many large marble stones. For this reason, and also because in front of and behind this narrow defile at the caves the river is wide and plain, with a great deal of dry, sandy bottom, the natives call the river beyond the caves "Kabilang Ilog," meaning "Other River."

Beyond the caves there are 483 people in Bosoboso, town of the province of Rizal, and about 1,000 Negritos and Remontados, whose custom it is to build their houses or shelters on the sandy bottom of the river in the dry season.

Below the caves the river receives other streams, viz, Bulaburan, Aliae, Puray, Laan, Bulubuk, and Maanga (in Montalban) and Kalamoong, Ampid, and Nangka (in San Mateo). Many of these streams have no water during the dry season, but this is not true of the stream coming from the cave, nor of Bulubuk, Ampid, Nangka, and perhaps some others.

The river crosses the towns of Montalban, of 3,018 inhabitants; San Mateo, of 4,126 inhabitants, and Mariquina, of 7,164 inhabitants, in many points near the houses, and naturally receives the filth much more in time of rain. The natural condition at present of these towns, the poverty and ignorance of the majority of the inhabitants, the poor condition of the buildings, the necessity to keep domestic animals, etc., resist greatly any rigid policy of perfect sanitation in the present circumstances.

October 27, 1902.

SIXTO DE LOS ANGELES,
President of the Provincial Board of Health, Rizal.

EXHIBIT D.

OFFICE OF THE PROVINCIAL BOARD OF HEALTH,
PROVINCE OF LAGUNA,
Santa Cruz, March 22, 1903.

SIR: Complying with your request, I have the honor to make the following sanitary report for this province, together with health and hygienic measures adopted by the provincial and other boards of health as dictated by me.

On the 28th of September, 1902, I assumed charge of the position of president of the provincial board of health, and on that day organized the provincial board of health of La Laguna.

I at once issued instructions through the municipal presidents to all persons who wished to apply for the positions of president of municipal board of health to be established in each town. Various persons applied to this office for said positions, and with the approbation of the commissioner of public health of these islands they are now fulfilling said positions to the satisfaction of the provincial board of health.

Some towns of the province have no presidents for boards of health, because of the fact that the municipal treasury is without funds wherewith to meet their salary. These towns are Longos, Alaminos, Pila, Rizal, and Cabuyao. In these towns I have arranged for the formation of a health committee, with the powers of a municipal board of health.

The fact that certain presidents of municipal boards of health desire to resign arises from the lack of funds in the hands of the municipal council, the salary of these officials being necessarily slight on this account.

At present 25 municipal boards of health are organized in this province. Two of their presidents have presented their resignation. These are the presidents of the towns of San Pedro Tunasan and San Antonio. For a better and more ready understanding of the manner in which sanitary laws passed by the Civil Commission are to be complied with, I presented for the approbation of the provincial board of health certain instructions regulating the duties of the presidents of municipal boards of health and the duties of municipal boards of health in harmony with the sanitary laws approved by the Civil Commission. These instructions were accepted and approved by the provincial board of health on the 13th of January of this year. They were immediately distributed among the presidents of municipal boards of health and to health committees in the towns where municipal boards of health are not as yet organized.

Among other measures adopted by me for the health of the towns is a circular compelling the strict observance of law No. 262, relative to the interment and cremation of animals dying of rinderpest, prohibiting at the same time the use or sale of any part of the bodies of said animals.

Among the various duties of presidents of municipal boards of health and health committees the work of vaccination is given preference and is complied with with the greatest promptness.

The tubes of vaccine virus, received in this office from the commissioner of public health of these islands, have been distributed to the presidents of the municipal boards of health of the province. The result of vaccination in some towns is satisfactory, in others not, according to the returns officially forwarded me by said presidents. In the towns where health committees are established the president of the municipal board of health of the nearest town performs vaccinations. The cases of smallpox that have occurred in towns in years past have been mild, and never have assumed an epidemic form. From 1 to 20 per cent of the population was attacked, the majority of cases occurring among grown children. The measures adopted have always been vigorous, the house being quarantined and the patient isolated.

There have also been cases of measles in the river towns of this province, but they are mild and occasion but few deaths.

From the month of January, in the present year, only one case of smallpox has occurred. This was in one of the barrios of Santa Cruz and was not fatal.

Tuberculous leprosy is found in the towns of Calamba, Binan, Cavinti, Lumban, Luisiana, Mavitac, Pila, Pakil, San Pedro Tunasan, and San Pablo, but the number of cases is not large, as may be seen by the report forwarded to the commissioner of public health. As a preventive measure the isolation of persons attacked by leprosy and the destruction of everything used by them has been adopted.

During the cholera epidemic the military government, which was then in charge, had control of matters of hygiene in the entire province. On this point I can state that in the month of September, 1902, the sanitation of this province being then under the civil government, there occurred 1 case of cholera, without death, in the town of Magdalena. In the month of October following there were 23 cases in various towns in this province, 15 being fatal. After said month no cases occurred. During the course of the cholera epidemic the quarantining of the houses of persons attacked has been followed by the cremation of all the effects used by such persons, together with the complete disinfection of the house as precautionary measures.

Among the persons attacked by cholera, mentioned in the preceding paragraph, one was found on the line of boats running from Manila to this province. The measures adopted were opportune. Towns on the route of said steamers have been quarantined, and a complete disinfection of the boat, cargo, and passengers has been effected.

Among the 30 towns of this province there are some wherein the majority of the inhabitants, on account of climatological conditions, suffer from malaria, and it may be said that in these towns this disease is endemic. Magdalena is the greatest sufferer in this respect. The inhabitants of this town pay but little attention to the disease because of its great frequency, and the sites are very few in which malaria does not exist.

Foot-and-mouth disease, attacking horses, carabao, and cattle, known in this province. In the course of this disease it is noted that the hoofs of the animals fall off of their own accord. The animal attacked finally dies. Rinderpest has also been present in some of the towns, producing a mortality of 75 per cent. These diseases among animals have been of an epidemic character. The cases above mentioned have occurred in former years, but rinderpest was also present last year.

In order to secure an exact idea of the conditions reigning in the various towns of this province, I called together a general assembly of all the presidents of municipal boards of health, in the month of February of this year, in order to hear their opinion in regard to the sanitary conditions of their towns and to instruct them how to proceed in matters of hygiene. Many of the presidents of municipal boards of health are not acquainted with the sanitary laws, because of the fact that this office has not possessed copies to forward them. The result of the assembly has been satisfactory to all, and the presidents duly followed instructions issued by me.

In order that you may be better informed of the diseases present in the towns of the province, I include in this report a table of deaths, with causes, for last month.

On my visit of inspection to the various points in the province in January and February last I found hygienic conditions good, coming back satisfied with all measures issued by presidents of municipal boards of health.

In respect to economic conditions, I can state that according to official information received in this office from the provincial treasurer, certain towns do not find themselves in condition to pay the salary of the president of the board of health. This condition will exist until the collection of taxes is commenced.

At present, hygienic conditions are normal throughout all the province.

Before terminating the present report, I recommend that you make known to the commissioner of public health the necessity of appointing two vaccinators for the thirty towns in this province.

Very respectfully,

F. EJERCITO,

President of Provincial Board of Health.

Mr. L. A. B. STREET, *Medical Inspector.*

EXHIBIT F.

[Telegram received.]

CAVITE, *April 21, 22, 1903.*

Doctor STREET,

Insular Board of Health, Manila:

Number of deaths from cholera first half of 1902 is in report of this office which I am carrying for second half of year. Cavite, San Roque, and Caridad, 55 deaths. Will forward returns for other towns by mail as soon as data requested arrive. Rinderpest is prevalent; 206 animals affected, 192 deaths. Foot and mouth disease, 161 cases; 131 deaths in Naic. Am expecting returns from Maragondon.

M. FELIZARDO,

President Provincial Board of Health.

EXHIBIT G.

PROVINCE OF BATANGAS,
OFFICE OF THE PROVINCIAL SUPERVISOR,
Batangas, P. I., April 8, 1903.

SIR: Pursuant to your request, I have the honor to submit the following suggestions for increasing the efficiency of the provincial and municipal boards of health:

1. An American doctor as president of the provincial board of health.
2. Public laws designating suitable and uniform ordinances, with penalties, for making obligatory and effective the provisions of subsections l, m, n, o, p, q, r, and s of section 39 of the Municipal Code.
3. A provincial public hospital in which practicanes and nurses may receive training and experience.
4. Collaboration of vital statistics.
5. Distribution pamphlets in Tagalog, giving simple rules and information upon practical hygienic and sanitary methods which can be readily adopted in the rural home life of the masses.

Very respectfully,

CHAS. H. KENDALL,

Supervisor.

Doctor STREET, *Insular Board of Health.*

EXHIBIT E.

Table of deaths from various causes in the towns enumerated.

Town.	Approximate population.	Tuberculosis.	Anemia.	Beriberi.	Bronchitis, acute.	Malarial cachexia.	Senile debility.	Intestinal catarrh.	Croup.	Dysentery.	Eclampsia.	Erysipelas.	Gastric obstruction.	Hæmoptysis.	Scrofula.	Typhoid fever.
Nagcarlan	10,581	6	2	1	..	..	..	..	..	2	7	..	..	..	..	..
Pakil	1,625	2	..	..	1	..	..	..	..	..	1	..	..	..	..	1
Majayjay	5,720	5	..	3	..	..	..	..	..	..	..	..	..	..	..	..
Binan	9,804	6	3	1	1	4	..	..	..	2	3	3	2	..	..	..
Magdalena	2,345	2	..	..	..	..	..	1	1	1	1	..	..	..	..	4
Cavinti	4,245	4	..	..	1	..	..	..	..	3	4	..	..	..	..	..
Lilio	4,700	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Calanan	3,025	1	..	1	..	..	..	..	..	1	3	1	..	1	..	..
Santa Rosa	7,531	5	..	..	..	..	..	..	..	1	4	..	..	2	1	..
Paete	2,415	1	..	1	..	..	1	1	..	..	..	..	..	1	..	1
Calamba	5,683	..	..	..	..	..	3	..	..	1	1	..	..	..	..	..
Santa Cruz	11,464	9	1	5	3	..	..	5	..	..	3	3	..	..	..	1
Total		43	6	12	6	4	4	7	1	11	30	7	2	4	1	7

Town.	Approximate population.	Gastric fever.	Malarial fever.	Eruptive fever.	Puerperal fever.	Fever, unclassified.	Grippe.	Hernia.	Cerebral hemorrhage.	Metritis.	Nephritis.	Pneumonia.	Rabies.	Malignant tumor.	Tetanus.	Whooping cough.	Epilepsy.
Nagcarlan	10,581	4	9	2	1	..	..	2	..	..	..	..	..	..	..	..	..
Pakil	1,625	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Majayjay	5,720	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Binan	9,804	1	7	..	..	..	2	1	2	..	..	1	1	1	1	..	..
Magdalena	2,345	..	2	..	..	1	..	..	..	1	1	..	..	..	..	1	2
Cavinti	4,245	..	17	..	1	..	..	..	1	..	..	..	..	..	..	..	..
Lilio	4,700	3	7	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Calanan	3,025	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Santa Rosa	7,531	..	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Paete	2,415	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Calamba	5,683	..	10	..	..	..	..	..	1	1	..	..	..	..	..	..	..
Santa Cruz	11,464	..	11	..	..	..	..	..	1	..	..	..	..	..	..	..	..
Total		8	85	2	2	1	2	3	4	2	1	1	1	1	1	1	2

REPORT ON SANITARY CONDITIONS IN THE PROVINCES OF UNION, BENGUET, ILOCOS SUR, ILOCOS NORTE, ABRA, LEPANTO-BONTOC, CAGAYAN, AND ISABELA. BY DR. FRANK DUBOIS, SPECIAL SANITARY INSPECTOR.

MANILA, P. I., May 20, 1903.

SIR: In compliance with Special Orders, No. 22, February 20, 1903, your office, I have the honor to make the following report on the health and sanitary conditions of District A, comprising the provinces of Union, Benguet, Ilocos Sur, Ilocos Norte, Lepanto-Bontoc, Abra, Cagayan, and Isabela:

GENERAL HYGIENIC CONDITIONS AND THE CUSTOMS AND HABITS OF THE PEOPLE RELATIVE TO HYGIENE.

The towns are generally situated on the seacoast or on the rivers. The drinking water is taken from wells or holes in the sand near the sea or rivers. In the dry season and during the first part of the wet season a few of the educated class either boil their drinking water or plunge a large piece of red-hot iron into it to purify it.

No system of sewerage exists and no town has any well-constructed system of surface drainage. The people of the country districts and smaller towns have no

water-closets. In the larger towns the majority of the people have a rudely constructed water-closet of bamboo, built up off the ground, with no deposit vault. A few of the better classes have privy vaults of stone, built above the ground. These vaults are not tightly closed, and are generally purposely opened at the bottom. The hog, the common scavenger, eats the offal of the vaults, thus preventing its accumulation, and at the same time spreading intestinal diseases.

The family eat with the fingers from a dish common to all the members. The houses are built of bamboo, covered with nipa or grass, are open and well ventilated, and the floors are placed 4 or 5 feet above the ground. Cadavers are generally buried in a piece of patata in a shallow grave, and if burial space is needed the bones are later exhumed to give room for other bodies. In contagious diseases almost all the towns prohibit taking the corpse into the church and limit the number of people accompanying it to the grave.

The markets of the towns are on the ground under nipa sheds. They are generally very unsanitary—often placed on low, wet land, and in only a few of the larger towns are there any regulations for the control of them. Probably the most commendable custom in the district is the care the people give to the cleanliness of their bodies. They bathe frequently.

The above remarks apply only to the Christians occupying Union, Ilocos Sur, Ilocos Norte, Cagayan, and parts of Abra and Isabela. The non-Christian tribes occupying Benguet, Lepanto-Bontoc, and parts of Isabela and Abra, know absolutely nothing of sanitation or hygiene. Their conditions and customs are different from those of the Christian tribes. They do not keep their bodies clean. They prefer cooked food, but eat all classes of food raw, provided circumstances prevent cooking it. I can not say that eating the flesh of animals, dead or diseased, is a custom of theirs, but they have often been known to do so. A small portion of them in eastern Abra and northern Lepanto bury their dead under their houses. Those of Bontoc bury their dead in rude coffins in the crevices of the mountains, and the tribes of Benguet bury theirs near the house. The funeral ceremony, known as the "Death canyou" among the Igorrotes of Lepanto-Bontoc and Benguet, and the "Layog" among the Tinguanes of Abra and Lepanto, is conducive to the spread of contagion. On the death of a member of the family a feast, to which all the friends are invited, is held. It continues from one to five days, and the corpse, reclining or in a sitting posture in a corner of the room, is supposed to enjoy a farewell feast before departure.

PRINCIPAL DISEASES AND DEATH RATE.

Imperfect records and ignorance in diagnosis make it impossible to give accurate statistics on this subject. It was possible to make a fairly correct estimate of the death rate per 1,000 inhabitants for 1902 in the following provinces:

Union	63.6
Ilocos Sur	71.4
Ilocos Norte	56.3
Cagayan	72.0
Isabela	67.0

No death records of Abra and Lepanto-Bontoc are kept. Imperfect records of Benguet are kept. Abra had comparatively few deaths from cholera and smallpox. Lepanto-Bontoc, so far as I could ascertain, had none from cholera or smallpox. Benguet had about 700 deaths from cholera among its 20,000 inhabitants. From an examination of the municipal death records in Cervantes and Bangued and the records in the office of the governor of Benguet the following estimates per 1,000 inhabitants are submitted:

Abra	32.0
Lepanto-Bontoc	24.0
Benguet	50.0
Average for whole district	57.9

Both cholera and smallpox contributed to the high death rate in the Christian provinces. Cholera caused a higher rate of mortality in the more thickly populated provinces, as Union and Ilocos Sur; but in opposition to this last the smallpox caused many deaths in the thinly populated provinces, Cagayan and Isabela, and a few in the thickly settled districts. My estimate of the deaths is 46,076 out of 795,000 people. Of these deaths about 22,046, or 48 per cent, resulted from cholera, leaving 24,030 resulting from diseases common to the district.

"Calentura," a name covering almost all kinds of fever, is the most common disease of the district. It includes typhoid, malaria, and all the undetermined fevers, and until dependence can be placed in diagnosis made for the records it will be

impossible to tell the rate of death of the separate diseases included in this term. Calentura causes about 29 per cent of the yearly deaths or 15 per cent of the deaths in 1902. Typhoid is comparatively rare, and to me strangely so, considering the habits and customs of the people. It is scattered over the entire district, but the coast south of Vigan seems to have a few more cases than any other section. Malaria exists in all its various forms and probably causes a large majority of the deaths marked "calentura." Pernicious malaria, or what is believed to be pernicious malaria, seems to exist only in certain sections, the Cagayan Valley and the seacoast south of Vigan being the most noticeable.

"Tisis" is found in all sections of the district, with the possible exception of Benguet. If it exists in this province it is very rare. Doctor Thomas, Governor Pack, and ex-Governor Whitmarsh all stated that they had never seen a case of consumption among the Benguet Igorrotes. A few cases were recorded in Cervantes, the capital of Lepanto-Bontoc, but these were among Ilocanos, from the coast, and the number of cases among the Lepanto Igorrotes is extremely small, or none at all. The average yearly death rate is 9 per cent of all diseases, or $4\frac{1}{2}$ per cent in 1902, including deaths from cholera.

Smallpox causes about 14 per cent of all yearly deaths, or 7 per cent of those in 1902, including cholera.

The epidemic of cholera made it impossible to calculate the rate of mortality from dysentery and diarrhea, because these were almost constantly found as the diagnosis of a varying number of cases at the beginning and end of the epidemic. Comparatively few adults die of dysentery, but catarrhal enteritis is the cause of many deaths among children.

Beriberi is a widespread disease, but at present is causing only a few deaths. I did not find it in any provincial carcel. Each province has its quota of lepers. Ilocos Sur has most—over 300. Other common diseases that cause fewer deaths are dengue measles, many varieties of tropical skin disease, intestinal parasites, rheumatism, uræmia (especially the uræmia of pregnancy), childbirth, and septicæmia.

Fifty per cent of all yearly deaths, not taking the cholera records into consideration, occur among those marked 5 years or under. Malnutrition, resulting from lack of care and proper food and clothing, constitutes a large factor in the death of children. Most of these deaths are diagnosed "alferecia," eclampsia, and convulsions, but these are often symptoms resulting from malarial infections or catarrhal enteritis. Bronchitis, pneumonia, and meningitis cause a mentionable number of deaths of children.

THE CHOLERA EPIDEMIC.

The cholera began at two or three places along the west coast of the district at about the same time. Santo Tomas, Union, the most southern coast pueblo of the district, and San Esteban, Ilocos Sur, both had cases on July 9. The infection in Santo Tomas came from Dagupan, along the coast; that of San Esteban came from a small boat from a southern port. Four or five days later the infection was found near Laoag, Ilocos Norte. Starting from these points it spread rapidly, and was found in every town on the west coast of the district by August 1. From Dagupan it followed the line of trade up the new government road to Benguet, the first case in Benguet occurring July 24 in the government road camp near Twin Peaks. The Cagayan Valley was the latest to become infected. Cholera came into Isabela from the south, by way of Nueva Vizcaya, in the latter part of July. It appeared in Aparri in the first week in August. From these points it moved toward the center of the valley, the whole of the valley being infected by August 20.

The duration of the epidemic was about two and one-half months. Along the west coast it ended in September and October. In the Cagayan Valley it ended in October and November. Scattered cases were found along the west coast as late as November 1, and in the Cagayan Valley in December. Only one pueblo furnishes an exception to this rule. The record of deaths in Aparri shows that the longest space between deaths from cholera, from the time it started in August up to the time of my inspection of the pueblo in April, was about twenty days. It is my opinion that the town was not clean of the disease from the time it started until the time of my visit. During my trip through the Cagayan Valley the epidemic again began to spread from Aparri as a center, and Lalloc and Camalaniugan had a few cases when I left. These three towns were the only cholera-infected sites I found in the district.

The rapidity of the spread of the disease and the number of deaths per thousand inhabitants were proportional to the density of the population, the amount of travel and traffic in the section, and the purity of the water supply. The thickly settled west coast, with its greater traffic and impure drinking water, suffered more than the sparsely settled Cagayan Valley, with its small amount of traffic and its purer water.

Lepanto-Bontoc, which can be entered only by a few narrow trails, was easily quarantined and its usually light traffic with the coast almost abandoned. It therefore escaped the scourge. Abra, for the same reason, had only a few cases.

Almost every town I visited tried, or claimed to have tried, to follow the instructions sent out from the central office for fighting the disease. All provinces quarantined against it by closing ports and putting guards on the main lines of travel; but this quarantine was usually ineffective because of the small number of guards on land, the inability of the town or province to take care of the people quarantined, the comparatively large number of small boats that landed at any point they desired, and the widespread ignorance of quarantine in general. The same statement can be made in regard to the quarantine of infected houses. Many municipalities passed laws requiring the quarantining of infected houses, but the large number of cases and the ignorance of quarantine made the laws almost of no value. Even the natives of some education and intelligence know almost nothing of the methods of quarantine and the object to be obtained by it.

The entire people, doctors included, with very few exceptions, are ignorant of the disinfection. In the epidemic a majority of the towns received lime, carbolic acid, and bichloride of mercury; but no town in the district had enough disinfectants to supply one-third of its actual needs, and in some of the towns the disinfectants shipped to them from Manila, on account of slow transportation, arrived after the epidemic had passed. The little disinfection done by the natives amounted to nothing. Generally the markets were inspected. More than the usual attention was paid to their cleanliness, and the sale of objectionable food in them was prohibited.

A goodly number of the better educated people were careful as to what they ate or drank. A few families used only cooked food and boiled water, and many took more care in choosing and caring for their drinking water than ever before. This one injunction has made a greater and more widespread impression on the natives than any other sent out by the central office, and it is my opinion that it will prove of some value to them in time to come.

The sick of cholera were generally cared for in their houses by the members of the family. Having no knowledge of the infectious nature of the disease, those who cared for the sick took no precautions for their own health in the sick room. Almost all the pueblos had some anticholera remedy—paregoric, chlorodyne, Squibbs mixture, or some patent or proprietary medicine—but only those patients near the presidencia had the benefit of these remedies. Heart stimulants were seldom used, and special diet was seldom prepared for the sick. Probably two-thirds of the cases were not treated in any way whatever, except the care which the family gave them. A large per cent of the other one-third were treated by native "practicantes," almost all of whom knew absolutely nothing of the disease. Three towns—San Fernando, Vigan, and Aparri—had small hospitals, in which a small per cent of the cases were treated by doctors.

The towns buried those cases diagnosed cholera in special cemeteries. In some of the towns each barrio buried its dead in a site near the barrio, but generally one or two special cemeteries were set apart for the burial of the dead of the whole pueblo. But all the dead from cholera were not correctly diagnosed, and as a result every town of the district which was visited by the epidemic has a number of bodies dead of cholera in its regular cemetery. Some of these incorrect diagnoses were made through ignorance, others because of the influence of the family of the deceased. Batac and Laoag each had about 1,000 deaths from cholera, and in each of these towns about 500 cases were incorrectly diagnosed and buried in the old cemetery. Those diagnosed cholera were not taken to the church in the burial ceremony. From the records I have computed about 31,000 cases and 22,000 deaths, a rate of mortality of 71 per cent.

SMALLPOX.

Smallpox is epidemic in the whole district, and was epidemic in 1902 in Isabela, Cagayan, and parts of Ilocos Norte and Union. It is impossible to tell the number of cases, as no records of them are kept. The number of deaths in 1902 were about 3,000; about three-fourths of these were in Cagayan and Isabela. The province of Cagayan in 1902 had about as many deaths from smallpox as from cholera. Very little attention is paid to it by the natives, and although they all know the purpose of vaccination, only a few ask for it, and many object and try to escape it. In Ilocos Sur, Ilocos Norte, and Union, the vaccination by the army surgeons in 1900 and 1901 has probably held the disease in check during the last year. In these provinces nearly all the people were accessible to the army surgeons, and were vaccinated, but in Cagayan and Isabela, where comparatively few people are scattered over a much greater territory, only the people in or near the large towns were vaccinated. Parts

of these latter provinces have not been vaccinated for many years. Another cause for the continuance of the disease in Cagayan and Isabela is the fact that the transportation of virus to the interior of these provinces requires so much time that it is probably of little value by the time it is used. Either a small vaccine station should be placed in the Cagayan Valley, or the virus should be sent there on points, or in some better condition than at present. A large part of the virus used over the whole district during the past six months has given very poor results. The vaccination law is not generally in force, and the number vaccinated by the native vaccinators and presidents of boards of health has been comparatively few. Some of the provincial presidents stated that they had asked the central office repeatedly for virus and had failed to receive it. The provincial president of the board of health of Cagayan, having the disease in his province during the entire year and having 25,000 people to care for, received 9,000 units in that time. The effectiveness of this official's work might be contrasted with that of a vaccinator recently sent out from the central office for the purpose of vaccinating Abra Province. This man proceeded in a systematic way and according to the law on vaccination. He had been in the province about four weeks when I had seen him, and in that time he vaccinated more people than the whole number of units shipped into Cagayan Province in 1902. Benguet, Ilocos Sur, Abra, and Union have had a larger percentage of the population vaccinated within the past year than the other provinces. About 140,000 were vaccinated in the whole district. Lepanto-Bontoc has not been vaccinated since the American occupation. It should be treated in the same manner as Abra as quickly as circumstances will permit.

DYSENTERY AND TUBERCULOSIS.

About all that can be stated in regard to these two diseases is given above. There are no records giving the number of cases. I found it impossible from the records to compute the number of deaths from dysentery. But I think 2,200 deaths from tuberculosis in the whole district in 1902, or 9 per cent of the yearly deaths (not counting cholera) is fairly accurate. It seems to be evenly spread over all the provinces except those in the mountain districts. The people know nothing of its prevention.

ANIMAL DISEASE.

Surra killed about one-half of the horses in the entire district in the latter part of 1902. It did not invade Abra, Lepanto-Bontoc, and Benguet, and was more destructive in Cagayan and Union provinces than the others. Cagayan Valley lost not less than 75 per cent of its horses, Union lost over 50 per cent, Ilocos Norte and Ilocos Sur a smaller number—30 or 40 per cent. Rinderpest, or what I supposed was rinderpest, killed many cattle on the west coast in 1901 and in the Cagayan Valley in 1902. Within the past two years 60 per cent of the cattle of the district have died. There was an epidemic among the hogs in progress when I visited the district. It had not reached the mountain districts and certain parts of Ilocos Norte. I found it in Union, Cagayan, Isabela, and the southern towns of Ilocos Norte. Some Americans with whom I talked claimed it to be American hog cholera, but I am not able to state whether this is true or not. In its progress it was killing about 50 per cent.

ECONOMIC CONDITIONS.

The district is not in a prosperous condition. The cholera epidemic, the large loss of cattle, horses, and hogs, the partial failure of the rice crop of last year, the low price of tobacco, and the improvidence of the people have in some sections endangered their lives. The officials of one province (Union) were doubtful as to the ability of the natives to maintain themselves through this dry season. Ilocos Sur and Ilocos Norte, having lost less live stock and reaped better harvests, thought that although there might be a scarcity of food in the latter part of the dry season there was no danger of famine. The corn crop ordered planted by the insular government proved of value to the poor of Cagayan Valley. I was told that the dangerous period for that section had passed. The mountain districts have not suffered. The governor of Benguet said that the province had more land under cultivation last year than in many years previous. There is, in my opinion, no danger from famine, but the lack of food of good quality will probably reduce the resisting powers of the people of some sections so much as to cause deaths that otherwise might not occur. However, this probably happens to a small per cent of the people yearly. They are so improvident that any economic mishap which would have no effect upon the life of a civilized nation causes them to live on food of a poor quality.

THE WORK OF THE BOARDS OF HEALTH.

Union, Ilocos Sur, Ilocos Norte, Cagayan, and Isabela have regularly organized provincial boards of health as per act 307. Abra, Lepanto-Bontoc, and Benguet have no provincial boards. Union has 9 municipal boards of health; Ilocos Sur and Ilocos Norte 3; Cagayan 4, and Isabela 4, making 27 in the district. Communications that I have received from the provincial boards of health presidents since my return state that 7 new municipal boards have been formed. It may be possible within the next few months to form a few more, but only a few, for the above number represents about all the graduate physicians and undergraduates of medicine in the district, and they also represent about all the pueblos that are at present able to support boards of health.

The provincial boards of health presidents are native doctors. With possibly one or two exceptions, they lack administrative and executive ability sufficient to do the work allotted to them. The amount of travel they have done in their provinces for the inspection and instruction of those under them has been much less than it should be. They have the mistaken idea that their duty consists in collecting and preparing statistics. They have not distributed many of the general orders and laws that everyone connected with the sanitation and health work of the islands should receive and know; nor have they required the officials to follow the laws and orders which they have distributed. In one province the provincial president of the board of health did not seem to know anything about the law on vaccination, and had not furnished a single copy of the law to the municipal doctors. Through ignorance of their duties, as much as anything else, they have wasted much of their time. Many of the municipal doctors know nothing more of their duties than that they were the official vaccinators of their respective pueblos; and their work in vaccination is so slow as to in many cases render the virus inert before it is used. Neither the provincial nor the municipal doctors seem to understand the importance of using virus immediately upon receipt of it. In no town did I find the vaccination law followed. These officials all need inspection and instruction, especially the latter; and the occasional visit of someone acquainted with the laws of sanitation and the laws of the islands would in time to come result in saving many lives. Even should these boards of health in the future be brought to a good state of efficiency, there are obstacles in their way that will probably resist good sanitation for many years to come. The people know nothing of the importance of modern sanitation, and generally look upon the boards of health as useless appendages to their government. Their old habits and customs, fatalistic ideas, belief in incantations, and small faith in modern medicine will constitute a stumbling block to the scientific health officer for many years. Another obstacle in the provinces is the fact that we have native justices of the peace. This statement is not made against their honesty, but not knowing anything about the importance of sanitation they are very liable to give any infringement of sanitary laws very little attention or unconsciously to shield the offender.

In conclusion, the following items that may be of some use in the future instruction of provincial and municipal boards of health are appended:

1. That provincial presidents of boards of health be definitely instructed as to their duties in distributing to municipal doctors all copies of laws, circulars, etc., relative to the board of health.

2. It is advised that some check on the amount of inspection and instruction of their municipal boards by provincial presidents of boards of health, be instituted.

3. More instruction should be given in the method of using police in the lawful method of procedure against infringement of sanitary laws and in the *modus operandi* of house quarantine.

4. A circular letter to all American teachers calling their attention to the fact that they are members of the municipal board of health, and that their help and cooperation is requested, would be of value.

5. All pueblos should be supplied with the regular register of deaths. Some do not have them.

6. All boards of health presidents should be furnished with the international nomenclature of diseases, and the names of the diseases should be translated into the native dialects, or Spanish, for the benefit of the municipal doctors. Until this is done no uniformity in diagnostic terms can be had over the archipelago.

This report is based on an examination of the records in the offices of the presidents of the provincial boards of health, the records of more than 25 pueblos visited, and the statements of American and Filipino officials throughout the district.

Very respectfully,

FRANK DU BOIS,
Provincial Health Inspector.

The COMMISSIONER OF PUBLIC HEALTH,
Manila, P. I.

REPORT OF SPECIAL SANITARY INSPECTION OF THE ISLANDS OF CEBU, BOHOL, SAMAR, AND LEYTE BY DR. CHARLES W. HACK, SPECIAL INSPECTOR.MANILA, P. I., *May 15, 1903.*

SIR: In compliance with Special Orders, No. 21, February 20, 1903, office of the board of health for the Philippine Islands, I have inspected the health district F, comprising Cebu, Bohol, Samar, and Leyte, and have the honor to render the following report:

HYGIENIC AND SANITARY CONDITIONS AS FOUND.

The hygienic and sanitary conditions of this district depend much more on the location of the towns than on any effort of the inhabitants. All of these islands are narrow, and with very few exceptions the pueblos are built along the low coast line and the site selected with a view to the accessibility to the sea rather than from a sanitary standpoint. Generally speaking, sanitary conditions are bad. There is usually an estero or sluggish river through the principal part of the town, into which rubbish, garbage, refuse, etc., is dumped and allowed to accumulate and over which as many houses are built as space will permit. These are the only substitutes for sewers. When the water runs out at low tide there is left a foul, stinking, slimy swamp, the odor from which is sickening to one not accustomed to it. There is little or no attempt made in most places to clean the streets, yards, or waterways. The pueblos of Barili, Cebu; Ormoc, Leyte; Calbayog, Samar, and many others have accumulations of filth for months. The city of Cebu itself is but little better. No attempt is made to install sanitary water-closets outside of a few of the larger places. The substitute for a closet in general use consists of four bamboo poles stuck in the ground, with a small platform of the same material built up some feet, and a nipa screen on one or more sides. There are no vaults, and the hogs are allowed to feed on the offal. It is no uncommon sight to see hogs in the streets covered with human feces. I mention these facts as being a possible cause of the spread of some diseases. The water-closet in the better houses is generally in or directly communicating with the kitchen. Hogs, cattle, horses, and carabao are allowed to roam through the streets at will. The water supply is from surface wells, streams, or springs. Pools of stagnant water are allowed to stand in the streets and under or near the houses, making excellent breeding places for mosquitoes. In many places contagious cases are not isolated or quarantined. Cholera has existed in Ormoc, Leyte, since August 19, 1902, and so far as I could ascertain no attempt is being made to stamp it out. The facts that the houses are built up off the ground and that they are open and well ventilated, are about the only sanitary and hygienic conditions for which the average native is responsible. All of these things do not apply to all of the towns, but to most of them.

CUSTOMS AND HABITS OF THE PEOPLE RELATIVE TO HEALTH AND SANITATION.

These are just as the unsanitary conditions of the pueblos would indicate. The people crowd together as many in a house as can find sleeping space. One house visited had 35 occupants. The food is eaten raw to a great extent. I was informed by American school-teachers that it was common for children to start for school without breakfast, and depend entirely for sustenance on what vegetation or sea food they could pick up on the way. When the food is prepared, many eat with their hands from the same dish, and in markets and other public places where food is served in individual dishes the same spoons and dishes are used over and over again without washing. The meats and other foods on sale in the markets and tiendas are handled by many dirty hands before being sold. The children are poorly clad, if at all, and are allowed to eat anything they can find. These facts probably account for the comparatively large death rate among children. Water for all purposes is taken from streams, shallow wells, or pools, and not boiled or filtered for drinking. Clothing is washed in cold water, and many times in dirty pools, and as a result many varieties of skin diseases are prevalent. Pigs and dogs are kept in the houses. When the native bathes, he either goes into the kitchen and lets the water run through the floor and stand in a stagnant pool, or goes directly to the well and forms unsightly pools there. Men, women, and children defecate and urinate in the streets, yards, and public place. It is hardly safe to walk along the beach in many towns. Women show no more modesty in these matters than the men. The people are either indifferent or directly antagonistic to sanitary or hygienic measures. Quarantine is opposed, contagious diseases concealed, and vaccination hindered. In support of this, I append the translation of a letter to the president of the provincial board of

health of Cebu, from the president of the city of Cebu, in which he states that quarantine methods proposed against smallpox are "attempts against the respectable, old, and well-rooted habits of the natives," and refusing to punish natives and Spanish doctors who helped to conceal cases of contagious diseases. When a patient is taken ill with a contagious disease, instead of being quarantined, the neighbors gather in the house and a feast is prepared. I called to see the president of the town of Tagbilaran, Bohol, who was being treated for cholera by the president of the provincial board of health, and found the entire house filled with neighbors who had no more business there than to just follow out the old native customs. After death the body is generally taken to the church, services held, and the body buried in the same graveyard in general use. The president of the provincial board of health of Samar informed me that many bodies dead of cholera were buried no more than 6 inches deep in the public cemetery. But two of the towns in this district have doctors, and the natives refuse to take medicine furnished by the board of health, much more faith being put in candles and incantations than modern medicines. The people are superstitious and suspicious. It was common, I am told, in cholera times to hear of the Americans being accused of poisoning the wells.

THE DISEASES COMMON IN THE LOCALITY.

Notwithstanding the unsanitary conditions as found and the unhygienic and unsanitary customs and habits of the people, the general health is very good. In 1902 about 20,000 people died of cholera in this district, and a large number from smallpox, and while both of these diseases still exist to some extent in each province, but few cases were found or reported.

Malaria is prevalent and causes many deaths. In the province of Cebu 472 deaths were reported from this cause from July 1 to December 31, inclusive, in 1902. Mosquitoes are very plentiful in all parts visited.

Beriberi is common, particularly among native troops and in prisons. Cebu reports 360 deaths in the last six months of 1902.

Tuberculosis is very common, and causes many deaths, but no records of cases were obtainable.

Trancasa, or dengue, is probably the most widespread disease of any in this part. However, while few escaped an attack, there were but few deaths.

Leprosy is prevalent everywhere. Cebu Province has over 500 cases, 210 of which are in the leper hospital of the city of Cebu. The other 300 reported cases are not isolated, but live with their families, no attempt being made to prevent the spread of the disease. One patient recently admitted to the hospital is soon to give birth to a child. These cases are not prevented from leaving the hospital by guards. Bohol has 107 reported cases. The other provinces have no records of cases and do not isolate them.

Measles caused 87 deaths in the province of Cebu the second semester of 1902, but was not common in the other provinces.

Diarrhea caused 77 deaths in Cebu in 1902, and is very common, particularly among children.

Uræmia in pregnant women, puerperal septicaemia, and malparto are common, and cause many deaths.

Rheumatism, cerebral hemorrhage, erysipelas, and meningitis cause many deaths. Skin diseases of many varieties are common. Dysentery does not seem to be prevalent in this district.

The average death rate per 1,000 for six months ending December 31, 1902, was estimated to be:

Cebu	25.50
Bohol	31.60
Leyte	22.30
Samar	25.00

THE HISTORY OF CHOLERA.

Cholera first made its appearance in this district in Amabong, a barrio of Tacloban, Leyte, brought there on May 10, 1902, by a small native trading boat that came into port with two cases on board. Information is not obtainable as to where these cases were from. From Tacloban it spread very rapidly to all towns in the province, aided materially in its progress by the intercourse one town has with another, and their uncooked food eaten from their unwashed hands, on which are cultivated long, filthy nails. From Leyte it was carried across the strait in small boats to Basay, Samar. From here it spread like wildfire into the hills back of that place. Strict

quarantine was established at Catbalogan, and that place escaped with very few cases. It was next reported at Calbayog, farther up the coast, where there was no quarantine. From there it was carried by boats to the small adjoining islands of the province, and then up the Gandara River to the interior of Samar. In Tubigan, on the island of Bual, out of a population of 165 there were 140 cases, with 120 deaths. At Bioso, on the same island, out of a population of 300 there were 200 cases, with 156 deaths. The town of Paranus, Samar, with a population of 2,000, was depopulated in ten days. Those who did not die in this time fled to the hills, where many more died. About the end of September the disease began to rapidly decrease in Samar, but it appeared again up the Gandara River January 4, 1903. It did not last long this time, and at present Samar and Leyte are, with a few exceptions, clean. There are a few cases in Villareal, Samar, and Ormoc, Leyte. On July 11, 1902, cholera was introduced into Cebu, Cebu Province, by a Japanese servant from Manila. The spread through this province was much the same as through Samar and Leyte, usually along the waterways. On July 20, 1902, it appeared on Bohol, and has existed there since that time. April 14, 1903, it appeared in Tagbilaran a second time. This last outbreak was probably due to the bringing together of a large number of native school-teachers from all parts of Bohol, and caused the death of Judge Carlock and the president of Tagbilaran. All of these provinces suffered great loss. The following cholera statistics were taken from the records on file in the offices of the provincial boards of health:

	Cases.	Deaths.	Mortality.
			<i>Per cent.</i>
Bohol	5,571	3,627	68.7
Cebu	13,511	6,520	48.2
Leyte		4,625	
Samar	3,771	3,175	84.2
Average mortality			58.0

These figures are no more than estimates, and are probably much less than the actual numbers. Many towns have never rendered any returns at all, and have no records of any cases or deaths. In most cases where records are kept the diagnoses are made by the padre or others equally unscientific, and are wholly unreliable. In one town the records of death showed one entire page of deaths from cholera, and the next page all were marked natural deaths, and on the following page all cholera again. The records of Samar show a mortality nearly twice as great as that of Cebu, but I am inclined to believe the Samar mortality is more nearly correct. A very large percentage of the cases were without medical attendance. In towns where there were Americans to take charge of the work, a vigorous campaign was carried on against the spread of the epidemic. Uninhabited islands were selected for quarantine and hospital camps and for burial purposes, houses were disinfected or burned, and medical attendance and advice given as far as possible. The people were instructed in the preparation of food, boiling of water, and in quarantine. The provincial boards of health sent circulars of instructions to the municipal boards of health. Some of the Filipinos also did good work, the best they knew, but this did not apply to the majority of places, in many of which the only effort to stay the progress of the disease appears to have been the holding of religious processions. The bodies in these towns were generally buried in the cemeteries in general use, particularly the well-to-do ones, as that is consecrated ground. The medical and other officers of the army did much good work to suppress cholera, but in places I am informed their efforts were misunderstood by the natives to be interferences. Complaints were made against them and they were compelled to desist. At present the military takes no part in the management of municipal or provincial affairs without special orders.

Smallpox exists in these provinces at all times, but in 1902 it became epidemic and caused about two-thirds as many deaths as cholera. Twenty-three out of the 51 pueblos of Leyte report 1,373 deaths. Bohol reports 123 deaths during the last six months of 1902. Samar and Cebu have no complete records of cases, but both had a great many cases and deaths. I saw and heard of several cases among Americans in these two provinces. The natives have evidently grown accustomed to this malady and pay but little attention to it. They keep no record of cases, so that it is impossible to obtain authentic history or statistics of the disease, but from the number of blind and otherwise horribly disfigured Filipinos of all ages one sees throughout the provinces smallpox must have existed unhampered for generations. At present it is only

epidemic. Most municipalities have native vaccinators who generally carry on their work in a half-hearted sort of way, just enough to draw their salaries. In some places visited the salaried vaccinators did not vaccinate more than eight or ten patients per month, and there are everywhere many unprotected people. The vaccine sent out has been insufficient in quantity and has given a very small percentage of successful results. This is unfortunate, as the process of vaccination is attended with many difficulties, and it is hard enough to get some of the natives to submit even once. As there are but few ice plants in this district, and it requires months to communicate with some of the towns, the present system of sending out virus will not be a success, as the high degree of temperature and lack of care to which it is subjected renders it inert, even though it was good when sent out. The matter of vaccination is of the greatest importance here, as it is the only means of protection. Smallpox cases, as a rule, are not isolated or quarantined.

Tuberculosis exists, but it is impossible at present to ascertain to what extent, as few cases are diagnosed or reported. I was informed that it was very common all over the district, and owing to the universal habit of expectorating everywhere it will probably increase until the people can be educated to more sanitary methods and cases can be isolated.

DISEASES AMONG CATTLE AND OTHER ANIMALS.

In 1902 nearly all of the cattle and carabao in this district died of rinderpest. This disease has almost entirely died out now, probably due to the fact that there are so few animals left. Many horses died of surra and glanders. Hogs and chickens have died by the thousand, but I was unable to learn the cause or obtain an accurate description of the disease, as there has been no scientific investigation of the malady. Three cases of rinderpest among carabao were reported at Barili, Cebu, in April. At present there is an epidemic among horses throughout these provinces of a contagious, suppurative, lymphangitis, called by some "pseudo farcy," which causes a few deaths. Distemper exists among horses to some extent. Statistics in regard to disease among animals were not obtainable. In Leyte 8 municipalities lost 401 head of horses; 14 municipalities lost 2,931 head of carabao, 1,000 of these being in one pueblo. Nine municipalities lost 1,128 head of cattle, and 3 municipalities lost 401 head of hogs in 1902. In Bohol, where cattle raising is said to be one of the principal industries, very few cattle are left. The president of the board of health of Bohol reports good results from the use of the locust fungus.

BOARDS OF HEALTH.

Each province visited has a provincial board of health fully organized in accordance with act No. 307, and as far as practicable carries out the provisions of that act. However, their work is attended with greatest difficulties, and their working force is far too small for the work before them. They are but poorly equipped for the struggle they have with ignorance, willfulness, viciousness, and superstition of the people, with whom they have to deal, and all too many times the officials, who are leaders of these people, are as antagonistic to modern sanitation as their subject, if not openly, in a semisecret manner. The padres and presidentes in many instances fill the minds of the people with all sorts of unreasonable ideas, without regard to the truth. I am informed by the president of the board of health of Samar that the most popular candidate for the governorship of that island openly tells his people that before the Americans started quarantine and sanitary measures such contagious diseases as cholera, bubonic plague, etc., did not exist. The president of the provincial board of health accomplishes about as little by staying in his office and writing letters, circulars, and telegrams to the municipalities as the district medical inspector of this city would by sending polite notes to the people under his charge to put their houses in a sanitary condition. While in the capital of Leyte, being anxious to get more complete statistics, the president of the board of health, at my request, sent an urgent circular telegram to the municipal presidentes asking for certain reports by telegraph. Up to the time I left the district only two or three pueblos had responded. I found blank leper reports which had been sent out five or six months before to be filled out that were not even begun. The excuse invariably given for this neglect was that the time was all taken up with the census, illustrating how secondary health work is to everything else. Transportation is so infrequent and irregular that it is impracticable to make short trips out through the provinces; and as there is no one to take the place of the presidente if they leave their station, they hesitate to go away for two or three weeks at a time.

If each board was furnished with an assistant in the shape of a competent clerk to look after the office in his absence, he could inspect his towns and the municipal authorities could be instructed and sanitary laws enforced. The authority of the board at present is limited, and if they try to use what authority they have they usually result in at least a partial failure, as their cases must be tried before natives. If the health regulations for municipalities were made by the insular board of health, I believe more could be accomplished. The average municipal council is not apt to pass and enforce ordinances that every member of that body probably breaks many times daily. In Tacloban I am informed there is an ordinance against hogs running at large in the streets and prohibiting the building of nipa shacks over the estero in certain parts of the pueblo, yet all the efforts of the president of the provincial board of health to get the municipal presidente to enforce them have been a failure. The provincial secretary, according to act 307, "shall act as secretary of the board of health," but they usually have their time occupied with other work, and important circulars and letters have to wait sometimes two or three weeks for translation or copying. The presidents of the boards of health are expected to get authority from the governor of the Philippines to leave their province, yet in this district nearly all boats touch other provinces in making trips around any one province, and the time is often too short to get authority. The time of the president of the provincial board of health of Leyte is taken up with the inspection of boats that enter that port, and while he is apparently an earnest, hard-working man, his province is much neglected on that account. This work could be done by customs officials or a competent clerk or assistant.

Unfortunately there are only two towns in this district, aside from the provincial capital, which have duly qualified physicians or undergraduates of medicine, and therefore municipal boards of health can not be organized in conformity with act 308, but much good can and is being accomplished by making the municipal presidentes presidents of municipal boards of health. The so-called practicante will not be a success. They are generally more ignorant of sanitation and have less authority than the town presidentes. Their knowledge of medicine consists of binding leaves on the arms and legs of their patients. I visited some towns in Cebu that had good, intelligent presidentes, who were interested in the welfare of their pueblos, and were the only boards of health their places had, and found them in a very satisfactory condition. It can truly be said that the manner of the presidente can be determined by the appearance of his pueblo. The municipal presidente acts as president of the board of health in nearly all of the towns now, and as far as I could observe sanitation is being as well looked after as when special men, who were in most cases unqualified, were acting as presidents. I believe that by making board of health work one of the duties of the municipal presidentes, and supplying the presidentes of provincial boards of health with transportation and assistance, so that they can visit and instruct the various municipal boards, much good work can be accomplished. In many places American school-teachers take an interest in sanitation, and can be of much assistance in this work.

The idea of sending out provincial medical inspectors is an excellent one and will accomplish a great deal in the way of acquainting the insular board of health with the provincial boards and their workings and will cause them to take greater interest in their work. A few microscopes and post-mortem cases judiciously placed in the hands of certain provincial boards of health would, I believe, in time be the means of obtaining valuable information in regard to some of the obscure diseases of both man and animals. The boards of health are expected to care for the sick and wounded constabulary officers and men, but they are not supplied with the instruments or sufficient medicines. This is a matter of importance. I saw board of health doctors trying to care for some very seriously wounded constabulary men with such instruments as they personally owned or could borrow. Any medical or surgical supplies furnished the boards of health could be turned over to the constabulary medical department when one is in operation. I append a letter from Doctor Smith, of Cebu. The only hospitals in the district are in Cebu. The old Spanish leper hospital is being used for the isolation of lepers, but is in bad repair and by far too small. The nipa annexes to this institution and the substitutes for a city hospital and a smallpox hospital are no more than old shacks. As there are but two practicing physicians for an estimated population of 1,500,000 people, the capitals at least should be well equipped to care for the sick and wounded and to furnish medical supplies where needed. The only reorganization possible to accomplish was making the municipal presidentes responsible for the board of health work. Such instruction in handling contagious diseases, keeping records, and board of health work in general was given them as time would permit.

ECONOMIC CONDITIONS.

While these four provinces have suffered greatly during the last four years from war, cholera, smallpox, heavy loss from disease of carabao, horses, cattle, hogs, and chickens, and at present in places from lack of rain, with the exception of the east coast of Cebu, there does not seem to be any immediate danger of starvation of the people, and while the district is not in a very prosperous condition, nature so nearly supplies all of the actual necessities of these people, and their wants are so few, they have been able to withstand the strain of three or four hard years. I was informed that people on the east coast of Cebu were either actually starving to death or their resistance to disease so lowered by lack of proper quantity or quality of food that any intercurrent trouble would carry them off. I am inclined to believe the latter correct. However, in view of the fact that it is impossible to get sufficient responsible labor at any price to institute new business requiring a large amount of workmen, this seems unnecessary and causes one to think that their own laziness and improvidence is more nearly responsible than any frown of nature or circumstances. Ships, in places, have to wait for days at a time to get labor to discharge them and at the same time the port will be full of idle hombres who complain of being poor. It is said that there was difficulty in getting labor to unload and care for the rice the Philippine government sent out for the destitute. These islands are rich in natural resources, and only lack labor to work them. There seems to be but little planting going on, although hemp, cocoanuts, and other paying crops flourish. I saw what looked to be a very fair grade of coal in Samar and marble in Cebu. The schools have accomplished some good in many parts.

The above report is based on an inspection of 25 of the principal pueblos of the district, and on interviews with the provincial governors, presidents of boards of health, provincial treasurers, municipal authorities, school-teachers, and business men. The conditions are so similar all over the district that a mention of each town visited would only be repetitions, and a general report is made instead.

The time unavoidably lost in waiting for transportation made it impossible to visit a greater number of towns.

Very respectfully,

CHARLES W. HACK,
Provincial Medical Inspector.

The COMMISSIONER OF PUBLIC HEALTH,
Manila, P. I.

**REPORT OF SPECIAL SANITARY INSPECTION OF CAPIZ PROVINCE, PANAY, BY
DR. R. E. L. NEWBERNE, SPECIAL INSPECTOR.**

MANILA, P. I., *November 1, 1902.*

SIR: Having complied with Special Orders, No. 2, dated September 18, 1902, I have the honor to inform you that I left Capiz, Panay, on the 26th ultimo and arrived in this city to-day.

Supplemental to other reports on file in your office, from which statistical information may be obtained, I respectfully submit the following observations on the cholera situation, and the prevailing conditions in the province:

Capiz Province is situated on the northern coast line of the island of Panay. In natural resources, geographical position, and fertility of soil it is one of the most favored sections of the Philippine Islands. In its 34 municipalities there is an aggregate population of about 105,000, mostly Visayans, who are a remarkable people in many respects, though not so far advanced educationally as the Tagalogs. Capiz, with a population of 25,000, is the largest city, and the capital of the province of the same name. Calivo, near the ports of Legatic and Busuong, though smaller than the capital, is the chief commercial center, controlling the trade of the Aclan Valley district.

Capiz Province has been unfortunate in the loss of its cattle and carabaos through the ravages of rinderpest, and nearly all of its horses during the prevailing epidemic of surra.

These disasters were followed by a very deadly invasion of cholera, which was introduced by fishermen from the town of Estancia, in Iloilo Province.

About September 11 four men left Estancia in a small boat for Libas, a barrio of Capiz, arriving there on the following day, when two of them who had died on the voyage were landed on the beach and the third, sick with cholera, escaped from the boat and was afterwards found in a dying condition in a house in the barrio. The

other occupant of the boat rowed out to sea and probably returned to Estancia. The president of the provincial board of health was notified and visited Libas as soon as possible, but as the barrio is about 3 miles from Capiz he did not arrive in time to prevent infection. I mention these facts because the provincial supervisor has been charged with the responsibility for the introduction of cholera into the province.

The people of Capiz, anticipating an epidemic, erected by private subscription an excellent 60-patient hospital, and have maintained it partly by aid from the municipality and partly by contributions. Doctor Acuna, a recent graduate from the University of Madrid, has given his services in the wards free of charge.

I submit a separate report setting forth the cost of erection and maintenance of the hospital, and respectfully recommend the enterprise of the people of Capiz to other infected municipalities which are waiting for the insular board of health to do everything.

While the disease spread to the surrounding towns, it was possible for over a month to keep it out of the Aclan Valley district, through the aid of the Philippine Constabulary, under the command of the senior inspector, R. W. Preston, who rendered us every aid possible. The result of our efforts was simply to delay the spread of the epidemic. When Calivo, which is the outlet of the valley, became infected, Dr. T. H. Landor, captain and assistant surgeon, United States Volunteers, was detailed at your request to take charge of that portion of the province. Doctor Landor has been in Calivo for over three years, and is well acquainted with the people and holds their confidence and respect.

In the municipality of Capiz there are 4 Filipino physicians, 2 army surgeons, and several practicanes. With this number of physicians there will be no lack of medical supervision and advice.

I need not call your attention to the fact that these misfortunes have crippled the resources of the province and impoverished the people. If it were not for the kindness of the soil and munificence of the rivers and waters, there might be grounds for apprehending a famine. Without cultivation the soil grows bananas, bread fruit, cocoanuts, and many other nutritious foods. Fish, other sea food, and game are plentiful. The rice crop has been greatly reduced, and I do not doubt but that these people will suffer because of the lack of many things to which they have been accustomed; but it is my opinion, based upon personal observation, and upon interviews with some of the leading men of the province, including 28 municipal presidentes, that there is no reason why anyone should die of starvation in Capiz Province, unless he is too sick to avail himself of the food which may be had with very little effort.

The situation at present is not altogether gloomy, and justifies the belief that the outlook is favorable.

The provincial board has been authorized to loan 10,000 pesos from the bridge and road fund to the towns for the purpose of suppressing cholera. I see very little more that the insular board of health can do, except to send them such medicines as they may not be able to obtain otherwise.

Very respectfully,

R. E. L. NEWBERNE,
Medical Inspector.

The COMMISSIONER OF PUBLIC HEALTH,
Manila, P. I.

REPORT RELATIVE TO THE INOCULATION OF CATTLE AGAINST RINDERPEST, ISLAND OF TABLAS, BY DR. F. M. OWEN, VETERINARIAN, BOARD OF HEALTH.

MANILA, P. I., August 22, 1903.

SIR: In compliance with your request I have the honor to submit a report of all animals inoculated against rinderpest under my supervision on the island of Tablas, province of Romblon.

I left Manila on April 15 and arrived at Santa Fe, Tablas, on April 21, and began inoculating on the day following. I found the coast extending between Santa Fe and Looc, Tablas, badly infected, owing to the fact that dead animals were carried from place to place by the tide.

The following is a report of the inoculations, reactions, etc.:

April 22.—Inoculated 25 carabaos, 5 miles from Santa Fe, by the simultaneous method. The temperatures of these animals were recorded for ten days, noting all reactions. Mortality, 1 death.

April 23.—Inoculated 55 carabaos in Santa Fe by simultaneous method. Sixty-five per cent showed reactions by an elevation of temperature and sluggish appearance. Mortality, 2 deaths.

April 25.—Inoculated 35 carabaos, 1 mile from Looc, Tablas, 21 of which received virulent blood; no deaths. Fourteen received serum only. Mortality, 7 deaths. All animals that received serum only showed symptoms of the disease more or less at the time of inoculation.

April 26.—Inoculated 21 animals, 4 miles from Looc, 15 of which were carabaos. Thirteen received virulent blood; no deaths. Two were inoculated with serum only, of which 1 died. Six cattle received virulent blood, although these animals showed signs of the disease at time of inoculation; of these 2 died.

April 30 to May 4.—Inoculated 184 carabaos, 137 of which received virulent blood and 47 serum only. The records of these animals could not be obtained, as they were owned by many different owners from every section around Looc.

May 5.—Inoculated 77 animals, 3 miles from Looc, 37 of which were carabaos, and received virulent blood; no deaths. Forty cattle which were badly infected received serum only. These cattle being wild, no record could be obtained.

May 14.—Inoculated 301 animals in Alcantara, Tablas, 243 of which received virulent blood; no deaths. Fifty-eight received serum only; no deaths. Ninety-eight of these animals were cattle. This stock was under close observation for twelve days.

May 16.—Inoculated 28 animals in Ferrol, Tablas, with virulent blood. Temperatures were recorded of these animals daily and excellent results were obtained. No deaths.

June 8 to June 13.—Inoculated 470 animals in Odiongan, Tablas. These animals were free from rinderpest and were given serum only, as the virulent blood could not be obtained. Twenty-one of these animals died within fourteen days after inoculation. The serum given on this occasion was of a different shipment, and the results were not as satisfactory as the shipments prior and since that time. Deaths were reported to me that occurred thirty-five days after inoculation. However, the disease has disappeared in that locality.

July 4 to July 14.—Inoculated 70 carabaos at Odiongan, 40 of which received virulent blood, resulting in 1 death. Thirty received serum only; six deaths. New shipment of serum used on this occasion.

July 17 to August 5.—Inoculated 136 carabaos at Despujol, Tablas, 89 of which received virulent blood, resulting in no deaths. Forty-seven received serum only; no deaths. No records were taken of these animals after August 8, as only a small per cent had been inoculated after August 1. Total number of animals inoculated, 1,402.

The first noticeable change of reaction is from eight to twelve days after the inoculation, and shows more strongly on aged and pregnant animals than others. The paint which is used to mark these animals is unsatisfactory, as it is easily rubbed off in the mud. I recommend that a small branding iron be used, or an ear tip, which is used on many registered cattle in the States.

Very respectfully,

THOMAS M. OWEN,
Veterinarian, Board of Health.

Dr. J. W. JOBLING,
Director Serum Laboratory, Manila, P. I.

APPENDIX B.

REPORT OF THE CHIEF QUARANTINE OFFICER.

UNITED STATES TREASURY DEPARTMENT,
PUBLIC HEALTH AND MARINE-HOSPITAL SERVICE,
OFFICE CHIEF QUARANTINE OFFICER PHILIPPINE ISLANDS,
Manila, P. I., September 4, 1903.

SIR: In pursuance of the instructions contained in your letters dated June 27 and August 24, 1903, I have the honor to hereby submit a report of the quarantine transactions in the Philippine Archipelago for the year ended August 31, 1903.

The financial report is made for the fiscal year ending June 30, 1903, and includes July and August, 1903.

As the work of the Service is confined principally to the quarantinable diseases the report will commence with a brief summary under the head of each disease.

CHOLERA.

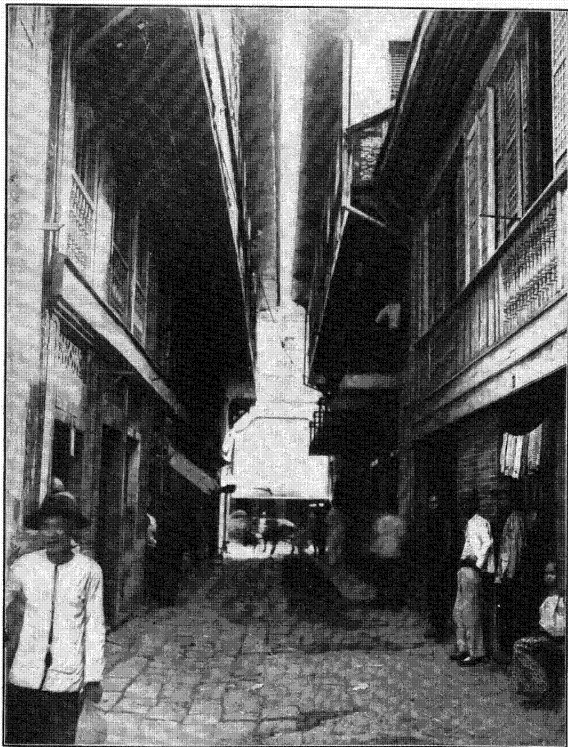
Sixty-eight vessels with cholera on board arrived at this port, and 37 vessels had cholera appear on board during the time they were serving their outgoing quarantine. This makes a total of 105 vessels disinfected for cholera.

The epidemic has taxed the resources of the stations to the utmost, and the long period over which it has continued has left several of the officers on duty in the islands almost physically exhausted. The large amount of work caused by the many infected ships and the incoming and outgoing quarantine can scarcely be realized by the perusal of the figures alone. It is probably the first time in the history of quarantine that so many ships were treated in a scientific manner. It is a matter of congratulation that the practice prescribed by the United States Quarantine Laws and Regulations has been so thoroughly vindicated by practical experience. Of the 105 cholera-infected vessels that were disinfected at the Manila station, only one developed the disease after being released from quarantine, and then nine days after disinfection; the cases developing in the ship's hospital among the dysentery cases. It has been contended that with the facilities of a modern troopship cholera could be as effectually stamped out while the vessel is at sea as when the facilities of a modern quarantine station are at hand. That such is not the case was well shown in the instance of the U. S. Army transport *Sherman*, which left here September 4, 1902. Two days after her departure cholera developed on board, and before the port of Nagasaki could be reached four cases had made their appearance, and before the passengers could be properly quarantined on shore six more cases developed. When it is considered that the four cases mentioned above occurred on

a modern troopship, where every possible provision is made for stamping out infection, and that these vessels have medical officers on board who have had special training, and in spite of these advantages the cholera spread, it is certainly reasonable to assume that quarantine for all ships, in cholera epidemics like the present one, is a necessity. The assumption is still further fortified by the fact that three other vessels had experiences similar to that of the *Sherman*, and in the large number of cholera-infected vessels treated at Mariveles one case after disinfection was all that ever appeared, and even that happened only once. It has been the experience here that on the appearance of the first case, prompt removal from the ship of the patient and the contacts and disinfection of the vessel generally resulted in the disease being confined to the original case. Had the cholera of the *Sherman* occurred in mid-ocean, or at a place where the facilities of a quarantine station were not at hand, it is difficult to say when the spread of the disease would have been checked. In this case the vessel was only two days from Nagasaki when the disease appeared.

The dissemination of the cholera has been widespread throughout the islands. From the commencement of the epidemic, March 18, 1902, until the ending of the fiscal year, 1903, there have been reported and made a matter of record 138,639 cases, with 88,761 deaths, which gives a mortality of 63 per cent. A conservative estimate made by medical men of large experience in the islands places the estimate at least one additional case for every one that was reported, which would make in round numbers about 300,000 cases. The proximity of the islands to one another, and the many small craft that ply between the islands at places where inspection is practically impossible, rendered interisland maritime quarantine almost useless as a means to check the spread of the disease when it once gained a foothold in the islands.

One of the most difficult problems encountered has been the management of cargo, and especially of vegetables. The daily question has been, "Are they infected?" An extended search through the literature of the disease fails to reveal much information that would be of service to the quarantine officer. Opinions, presumptions, and unsupported statements occur in profusion, but so far it has been impossible to find an authoritative statement that sheds much light on the question. The question of vegetables is a very serious one to Manila. All products of this kind are not produced in sufficient quantities in the islands to supply the market, and they must therefore be imported. The principal importations come from China. Since cholera is practically endemic in the districts in which the vegetables are grown, and the farms are fertilized with liquid human excrement, it would seem that the exclusion of vegetables from these districts was justified on theory at least. On the other hand, it is pertinent to state that during the past six months the city of Hongkong has been consuming the vegetables from districts which are suspected of being infected, and yet no case of cholera has made its appearance in that city during the period mentioned. It is a serious matter to deprive a city like Manila of a great portion of its food supply in the way of vegetables. The price of these articles became greatly enhanced. The population had to depend principally upon canned goods for their supply. During the latter portion of the epidemic the trouble was overcome to a great extent by the officers of the Public Health and Marine-Hospital Service, stationed in China and Japan, being able to certify that such vege-



STREET IN DISTRICT INHABITED BY CHINESE.

A large proportion of plague cases occurred in this district.

tables as were allowed to be shipped to Manila had not been grown in infected territory or exposed to infection in transit. With the view of being able to obtain more accurate information about cargo, the detail of a competent bacteriologist has been requested. The material exists here for making practical tests of this nature, and results might be obtained which would make it possible to lessen the restrictions which are placed on commerce at the present time.

During the early part of February, 1903, the cholera situation improved so much in Manila that the circular letter of February 4 (copy of which is embodied herein) was issued. On May 7 the cholera again assumed such proportions in Manila that an outgoing quarantine of five days was placed on vessels carrying steerage passengers to the United States. The situation up to the present time has not warranted the complete withdrawal of the restriction. The principal danger at this writing, so far as Manila is concerned, is the fact that cholera is present in the villages situated on the watershed from which the city drinking water is obtained. During the past few weeks there have been several cases reported daily from the village of San Mateo, which is situated on the bank of the Mariquina River, about a mile above the point at which the intake is located. The rainy season has not commenced yet, and for that reason the water in the stream is low, and if the river should become infected most of the infection would find its way into the Manila water system. The constant menace which hangs over the city will therefore be appreciated.

PLAGUE.

It is particularly creditable to the officers on duty in China and Japan that, notwithstanding that plague has been epidemic at Hongkong and Amoy during the year and present at other ports in those countries, not a single case of this disease found in Manila could be traced to infection from without. This fact is particularly noteworthy because the plague at Hongkong and Amoy has been epidemic, and these ports are only two and three days' sail, respectively, from Manila. It is also a matter for congratulation that the plague has been confined to Manila. So far the other ports in the Philippines have not become infected. Much of the success in the management of the plague is no doubt due to the mutual cooperation between the board of health and the Public Health and Marine-Hospital Service. An effort has been made to fumigate with sulphur, for the purpose of killing rats and vermin, the entire shipping which enters the port of Manila. This work has been almost accomplished, there being very few vessels that have not been fumigated at least once. The board of health has kept a force of rat catchers along the water front, and has fumigated with sulphur all the smaller vessels which are engaged in river and harbor work. During the year 163 vessels were fumigated at Manila, for which purpose about 20 tons of sulphur were used.

On the whole we have had the hearty cooperation of the shipping interests in this work. In addition to the destruction of rats, the destruction of cockroaches and other vermin on board vessels was very agreeable to them. The work so far has been accomplished with practically no delay or loss to shipping. It has been the custom heretofore to suggest to the steamship companies not to bring steerage passengers during that portion of the year in which plague was at its

height in Hongkong and Amoy. This suggestion has always been complied with in the past. This year a different course was pursued. It was found that abolishing the steerage accommodations for the time being resulted in that class of passengers engaging cabin accommodations. This made the last condition worse than the first, because they avoided thereby the measures which would have been employed had they been allowed to come as steerage passengers. The method of procedure this year has been, whenever possible, to detain them under medical observation for seven days at the port of embarkation, and after bathing them and disinfecting their effects they are permitted to proceed to Manila. Upon their arrival here they are again bathed and their effects disinfected. If they made no objection the board of health injected them with Shiga serum before landing. In summing the matter up, however, it is probably safe to say that the principal factor in dealing with the plague was that the rats and vermin were destroyed in the vessels before the plague epidemic began and then kept free from vermin since that time. The same course has been pursued at the other ports of entry in the islands.

Two vessels which were lying in the harbor were reported to us by the board of health as having had a case of plague on board. These vessels were remanded to Mariveles and thoroughly disinfected and held to complete the incubation period of the disease. No further cases developed on either vessel. The length of time that the vessels had been in Philippine waters shows that the disease no doubt was contracted in Man'ila.

SMALLPOX.

Five vessels arrived at Manila with smallpox on board. The usual course was pursued; nothing of note occurred; 8,972 persons were vaccinated.

LEPROSY.

This disease was detected on five vessels during the year. Four of the cases were in transit to Hongkong. One was ordered returned to Hongkong by the collector of customs, acting on the authority of the immigration laws. The remaining case was taken in charge by the board of health and placed in the San Lazaro Leper Hospital. The necessary precautions to prevent the spread of the disease were taken in each case.

The quarantine work in the islands has received much assistance from the medical officers of the United States Public Health and Marine-Hospital Service, who are stationed at the principal ports of China and Japan. Although their work is almost entirely for the benefit of the Philippines, the United States Government maintains these officers at its own expense, no part of the same being borne by the insular government.

During the year the ports of Iloilo and Cebu have been supplied with floating disinfecting plants. It is now no longer necessary, as was customary during Spanish rule, to remand a vessel to Mariveles whenever a quarantinable disease makes its appearance on a vessel while at one of those ports.

The amount of time and money saved to shipping by this arrangement can well be imagined.

The history of some of the epidemics that have entered the islands prior to American occupation shows that some of them at least have entered from the south, and for that reason Asst. Surg. J. W. Ames was detailed to report upon the advisability of establishing a quarantine station at Jolo or Zamboanga.

After making the investigation he submitted the following report:

U. S. PUBLIC HEALTH AND MARINE-HOSPITAL SERVICE,

Jolo, P. I., April 28, 1903.

SIR: Pursuant to instructions in your letter of the 14th instant, directing me to proceed to Jolo and Zamboanga for the purpose of ascertaining whether conditions warranted the establishment at one of these ports of an inspection station under the authority of the Public Health and Marine-Hospital Service, I have the honor to make the following report:

Securing transportation on the U. S. Army transport *Liscum*, which left Manila on April 14, I arrived in Jolo four days later, and through the courtesy of the collector of customs was promptly placed in possession of full data bearing upon the subjects of foreign and domestic trade, immigration, and sanitation.

Jolo is a flourishing town, located on a small bay indenting the northwest coast of the island of that name, affording a safe anchorage at all seasons.

It is the home of the sultan of the Sulu Archipelago, and has been for many years the most important commercial outpost in the Moro country by reason of its accessibility to the neighboring ports of Singapore and Sandakan.

This favorable geographical relation makes it the natural distributing center of commerce, not only for the Sulu group, but also, through the branch houses of the large Chinese wholesale establishments of Jolo, for the entire southern portion of the island of Mindanao.

In the past year there have been 43 entries from foreign ports, bringing cargoes consisting chiefly of rice and other food stuffs, clothes, illuminating oil, and opium.

From Jolo these vessels return to Singapore by the way of Zamboanga and Iloilo, or via Zamboanga to Sandakan, or the German possessions in the Celebes group, carrying as exports hemp and hemp rope, copra, gums, pearls, and pearl shells.

Notwithstanding the severe cholera epidemic of the last year, which almost paralyzed trade throughout the Philippines as a whole, and in spite of the unrest following the Moro uprising in Mindanao, the volume of foreign trade increased 10 per cent over the year 1901, and the outlook for the future seems very bright.

The civil government has recognized this in the recent appropriation of a large amount for the purchase of a suitable building to be used for a custom-house and for the extension of the pier begun under Spanish control, whereby large steamers may discharge directly at the wharf.

When this latter facility is secured it is expected that a direct bimonthly service will be established with Singapore, and additional coastwise vessels placed on the local route to Mindanao.

In addition to island steamers making Jolo a regular port of call, there is a fleet of perhaps 500 Moro sailboats, or "sapits" as they are called, measuring from 3 to 12 tons, and with crews of 4 or 5 each, trading among the adjacent islands, with Jolo as a rendezvous.

These boats touch at all the coast towns of the archipelago, going frequently as far south as Borneo, and carrying, with absolutely no surveillance as far as customs and quarantine are concerned, large numbers of passengers and important consignments of native products.

They constitute, therefore, a constant menace, and become the chief agency in the dissemination of epidemic diseases.

It was through this avenue that cholera entered the island of Jolo last year, and, though checked at the gates of the town by the vigorous and consistent quarantine maintained by the military authorities, it spread with great rapidity among the neighboring Moro villages.

From Jolo I proceeded via the U. S. coast transport *Formosa* to Zamboanga, arriving there April 25. This is a rapidly growing town of 8,000 inhabitants, situated in the extreme southwestern part of the island of Mindanao, on a strait about 9 miles in width, through which the tide runs at a rate of 5 to 7 knots an hour.

Here are located the headquarters of the department of Mindanao and Jolo, together with a small garrison, and on account of its strategic position will doubtless long remain an important military post.

It is also the trading center for numerous large cocoanut plantations, copra being the chief item of export. There is no harbor at Zamboanga and but one small

wharf, owned by the Army and used exclusively by its transports. Commercial vessels are therefore obliged to anchor and discharge, under very adverse circumstances, in the open roadstead.

Trade is almost entirely domestic. During the year 1902 there were 118 arrivals from Philippine and 25 from foreign ports, and of these latter entries 18, or 72 per cent, were by way of Jolo. During this period 157 immigrants were admitted.

In view of the policy of the civil government to promptly discontinue ports of entry which enjoy but limited foreign trade, as shown recently in the case of Aparri, and in consideration of there being another port in close proximity to Zamboanga (Jolo), which could issue special license for such trade as might offer, it seems probable that Zamboanga will be abandoned for some protected port on the north coast of Mindanao.

It is evident from the facts that Jolo would be the logical point for the institution of an inspection service, since practically all vessels from foreign ports could be examined immediately on entering American waters, and all subsequent ports of call be in a measure protected.

Masters of vessels could be instructed here to promptly report at way points any sickness appearing on board after clearing from Jolo, and customs inspectors at those stations could be authorized to remand any vessel showing quarantinable diseases for disinfection to Iloilo or Cebu.

In view of these natural advantages for the prompt detection of infected vessels, I have to respectfully recommend that an inspection station be immediately established at the port of Jolo.

Respectfully,

J. W. AMESSE,

Assistant Surgeon, P. H. & M. H. S., on temporary detail.

Asst. Surg. VICTOR G. HEISER,

Chief Quarantine Officer, Manila, P. I.

In accordance with the recommendations contained in the above report a quarantine inspection station was opened at Jolo May 6, 1903.

Upon the completion of the quarantine station at Cebu, for which the Philippine Commission has appropriated \$30,000, it is the intention to move the floating plant at Cebu to Jolo, thus making an additional disinfecting plant in the islands and reducing still further the inconvenience and losses sustained by shipping owing to quarantinable diseases making their appearance on vessels.

ILOILO.

Much difficulty has been experienced during the year in caring for persons suffering with quarantinable diseases who arrived at Iloilo on vessels. In order to remedy this difficulty it is proposed to have a suitable site set aside for a quarantine reservation, which would be provided with the necessary facilities to detain passengers, to disinfect their effects, and to care for the sick.

CEBU.

The Philippine Commission has appropriated \$30,000 for the erection of a quarantine station at that port. It is the intention to remove the present floating plant to Jolo.

MARIVELES QUARANTINE STATION.

The station has proven equal to the demand made upon it in every way, with the exception of the housing of the steerage passengers. At present there is only room for about 800 of this class and the accommodations should be increased. While it is not likely that another widespread epidemic like the one through which we are just passing will again strike the islands, still it is best to be prepared. There

should be at least sufficient room to house an entire regiment in addition to the crew of the ship.

The many large ships coming alongside of the wharf and the destructive action of the teredo have rendered repairs to the extent of \$9,877 necessary to that structure during the year.

MANILA.

The office force of this Service is poorly housed. Up to the present time it has been impossible to obtain an office conveniently located for the shipping interests that rented for a sum that was within the bounds of reason. Conditions having become more settled, provision should be made in the new custom-house, or an office should be built on the water front near the captain of the port's office.

The work of the Service has increased steadily, and the continuous running of one launch being poor economy, the Commission has appropriated \$4,000 for the purchase of another launch.

During the latter part of May a careful study was made of the cholera cases that had occurred during the month previous, and it was observed that most of the cases that occurred among the shipping occurred on board vessels that were lying on the shallow side of the Pasig River and practically at such places along the shore at which bends and turns took place. This was no doubt due to the fact that the water was more sluggish at such places and was not well diluted with the tide. Assistant Surgeon Long was ordered to make a bacteriological examination of the water of the Pasig taken at various points. This examination showed that the cholera organisms were present in large numbers at the places where the water was sluggish and few or no organisms being present where the stream was swift. Much practical good resulted from this observation.

SUMMARY.

There are now on duty in the Philippines 4 commissioned officers at Manila and Mariveles; 1 each at Cebu, Iloilo, and Jolo; 1 pharmacist at Manila who acts as disbursing officer, chief clerk, and pharmacist; and 70 attendants who act in the capacity of clerks, launch crews, quarantine employees, etc.

Two hundred and seven vessels were fumigated with sulphur. One hundred and five cholera-infected vessels were disinfected. Seven smallpox and 2 plague infected vessels were disinfected, and in addition to these large figures there were 119 vessels disinfected because they came from infected ports.

With the possible exception of the work done at Tor, Egypt, there is probably more disinfection accomplished at the Mariveles Quarantine Station than at any other plant in the world. When it is considered that the work had to be accomplished with labor that speaks a foreign tongue and at best is uninclined to work, the result is to be marveled at, and reflects great credit on the officers who brought it about. The strain has told on the officers severely, two of them breaking down from physical exhaustion. When the amount of work is taken into consideration and that this is a trying tropical climate, with few facilities for obtaining labor, it would seem to be wise to fall into the footsteps of the Army and make the detail in the islands not to exceed two years.

In addition to the quarantine work the Service has conducted the physical examination of masters, pilots, patrons, and engineers; and also the men who enter the coast-guard service. A total of 163 applicants were examined, 11 of whom were rejected.

Commencing with the fiscal year 1904, the physical examination of arriving aliens will also be done by the Public Health and Marine-Hospital Service.

A considerable number of vessels were disinfected upon the request of the board of health because they had carried animals infected with rinderpest and other diseases peculiar to cattle.

The steamers operated by the Service in the different ports of the islands have been kept in a high state of efficiency, and the seamanlike manner in which they are handled has been the subject of much favorable comment. This is especially encouraging, because the vessels are operated more economically than any similar vessels in the islands.

To prevent the occurrence of quarantinable diseases in the islands after those present have been stamped out will require the strict observance of the quarantine laws and regulations at the ports of entry. As some of these ports are less than forty-eight hours by steamer from countries in which diseases like cholera are endemic, the problem will be a difficult one, and perhaps more than can be expected of the Quarantine Service alone, but with the assistance of an intelligent and energetic board of health it should not be impossible.

The circular letters relative to quarantine issued during the year are appended.

Tables showing in detail the work accomplished in the inspection, detention, and disinfection of vessels, and the financial report showing the receipts, expenditures, and disbursements, are also appended.

With the exception of the report of transactions, the work of the Service at the substations is all included in the report of the chief quarantine officer under the separate headings.

The reports of transactions for the fiscal year transmitted by the officers located at the substations in the Philippines follow:

U. S. PUBLIC HEALTH AND MARINE-HOSPITAL SERVICE,
OFFICE UNITED STATES QUARANTINE OFFICER,
Port of Cebu, P. I., July 30, 1903.

SIR: I have the honor to report as follows with regard to the maritime quarantine conducted by the Service at the port of Cebu, P. I., during the fiscal year ended June 30, 1903.

The health conditions at Cebu and surrounding islands at the beginning of this year were fairly good, with the exception of smallpox, which is always present in varying amount, and leprosy in the lazaretto.

Quarantinable diseases were present in Hongkong, from which port vessels came to Cebu on an average of two per month.

A large number of vessels came from Saigon, but that port remained uninfected, and danger from there was comparatively small.

As an instance of the danger from Hongkong one vessel, the *Kaifong*, had on arrival 134 stowaways, who of course were not known to have embarked by the officer on duty there and were not disinfected. This happened while Hongkong was badly infected with cholera.

Shipping during the year increased about 25 per cent, most of which was confined to the coasting trade. There was, however, a slight increase in foreign trade. Hemp is shipped in considerable quantity to the United States, principally to Boston via Suez.

The health conditions remained good until July 9, when cholera made its appearance, having been brought from the island of Leyte to a small town 4 miles from Cebu, and thence down the coast. On the appearance of cholera in Manila a quarantine was instituted against incoming vessels of all descriptions.

Native vessels called bancas enter Cebu at the rate of 20 to 30 daily, carry large numbers of natives, and are the great source of danger to the port. It is impossible to control their movements after they leave the larger ports, as they exist by thousands, are dirty, and peopled by the most ignorant natives, who take no precautions whatever. There is no doubt that the rapid spread of cholera from island to island was due principally to these. Most of the cholera cases taken from vessels during the epidemic came from these boats and from those lying in the mud flats near shore, as they get their water supply from the wells in the lowest portion of the city, where it is likely to be infected with drainage and seepage. No method is used to dispose of sewage except to throw it on the ground. A large number of these vessels were disinfected by the Service after having cases on board.

Immediately on the appearance of cholera an outgoing quarantine of five days was instituted against vessels leaving for other ports in the islands. This included bancas, and at one time 70 vessels and 600 people were in quarantine. This was rigidly enforced until July 30, 1902, when an order from the chief quarantine officer permitted vessels to clear for infected ports without detention. The detention was still necessary for vessels for clean ports. The epidemic was at its height from July 9 to about the middle of October, during which time there were in the city 1,300 cases and 700 deaths. After this the number of cases gradually decreased until only an occasional case was noted. The town had enough cases still to be considered continually infected.

In the early part of the epidemic the barge *Proteccion* started from Manila to Cebu in tow of a steamer. She broke from her tow during a storm and went ashore. She was finally recovered, but by the time she was raised and repaired did not arrive in Cebu until December 10, 1902. In the meantime disinfection was done under great difficulties, but with fairly good results. After the arrival of the barge fewer difficulties were encountered.

During the year no plague and only one case of smallpox was found on a vessel.

One case of leprosy arrived on a steamer from Hongkong and was certified as such. This case was returned to Hongkong on the same vessel by the collector of customs, acting as immigration officer.

Respectfully,

CARROLL FOX, *Assistant Surgeon.*

U. S. PUBLIC HEALTH AND MARINE-HOSPITAL SERVICE,
OFFICE UNITED STATES QUARANTINE OFFICER,
Port of Iloilo, P. I., July 31, 1903.

SIR: I have the honor to submit a report on the transactions of the Service at Iloilo during the fiscal year ended June 30, 1903:

The city of Iloilo, Panay, has an estimated population of about 20,000. The census figures not being available yet, accurate information can not be given. It is situated on a low plain, a few feet above the level of the sea. An arm of the sea and the Iloilo River places it on an island, which, with the island of Guimaras, affords a sheltered harbor for the largest vessels. The population is made up, with the exception of the troops, of a few Americans, Englishmen, quite a number of Spaniards, and a large number of Chinese and Filipinos.

The city is the principal sugar-exporting port in the islands. The river is navigable for vessels drawing not over 14.6 feet for a mile, that being the depth of water on the bar at high tide. About 100 foreign vessels touch here per year. These arrive with general cargo and rice, and take out sugar and dyewood. For boarding purposes a boarding launch 66 feet long, 9 crew, with a speed of 7 knots, is maintained. A floating plant, the barge *Esmeraldo*, a crew of 4, with two modern steam chambers and a sulphur furnace, is used for disinfecting purposes. The barge arrived at the station August 27, 1902.

The office of the quarantine officer is located in the building occupied as offices of the depot quartermaster. During the past year an epidemic of cholera visited Iloilo. The first cases were found on a small banca which had been lying in the river several days. Out of a crew of 12 there were 5 cases and 2 deaths. These men were promptly isolated, but my impression at the time was that the infection took place in Iloilo. After finding these cases there was a lull of a few days, during which there were rumors of cases all over the city. Then the board of health began reporting 10 to 20 to 30 cases per day. August 27 I found a case of cholera on a lorchia in the river. This removed all doubt in my mind as to the town being infected. The epidemic reached its height in November. December saw the decline of the epidemic and the advent of the northeast monsoon. In all, about 4,000 persons lost their lives; with a few exceptions all natives and usually the poorer class.

This is not surprising when we consider the unsanitary condition of the native shacks, the under part of which is used to deposit all refuse and sometimes made the

house of the family pig, the chickens and dogs occupying their owner's beds and rooms.

Water is obtained from surface wells, naturally very easy to infect. Contrast this with the white population who used distilled water and rain water in tanks, usually of iron and placed above the ground, and paid some attention to cleanliness and food, and we have a reason why they escaped cholera.

The Chinese population were also remarkably free from cholera. Few, if any, cases occurred among them; due probably to their tea-drinking habits, and most of them belonging to the merchant class were better able to look after themselves. The Chinese shopkeepers who handled articles of food had lattice screens in front of their counters to prevent their customers, principally natives, from handling articles in the shop and thus infecting them. From December to May there was entire absence of cholera. In the latter month there occurred 3 cases, all of which proved fatal.

Smallpox occurs seldom, as considerable compulsory vaccination has been done. There has been considerable leprosy in the interior of Panay, but in Iloilo but few cases can be seen on the streets. At one time all the lepers were segregated, but owing to lack of funds this policy was abandoned. So far as I know there never has been any plague in the city. There have been several epidemics of dengue, but no reported fatal cases. Beriberi and dysentery occur frequently, but malaria occurs seldom in town, but in the surrounding country it is frequently very fatal at certain seasons of the year.

As soon as the cholera was officially declared an outgoing quarantine was established, vessels for clean ports being held five days and disinfected if infected. As few ports were declared infected before Iloilo became infected rigid quarantine was enforced. But information was very difficult to obtain, and it was frequently necessary to hold vessels on suspicion based on rumors and information given by local firms through their correspondents. This information was usually found to be correct, especially so since no detention was imposed on vessels sailing for infected ports.

Another difficulty was with smaller vessels—the praos, bancas, and viloses. These small craft, ranging in size from 1 to 10 tons, carrying from 8 to 30 crew, represent the native trading element. They go from port to port, from Mindanao on the south to Luzon on the north, on voyages of several months' duration. Their usual cargoes are hats and clothes, linen and cotton goods.

Others take shorter voyages of a week or two, bringing in fish, dyewood, and firewood.

A great many are the only means of communication between the smaller towns. Several thousand of them touch annually at Iloilo.

Respectfully,

M. K. GWYN, *Assistant Surgeon.*

U. S. PUBLIC HEALTH AND MARINE-HOSPITAL SERVICE,

Port of Jolo, Jolo, P. I., July 31, 1903.

SIR: I have the honor to make a brief report of the transactions of the United States Public Health and Marine-Hospital Service for the period from the opening of this station to the ending of the fiscal year 1903, as follows:

On the 6th of May telegraphic orders were received from the chief quarantine officer for the Philippine Islands detailing me temporary quarantine officer at the port of Jolo, whereupon an inspection of arriving vessels was immediately instituted under the provisions of the United States quarantine laws and regulations. Previous to this time the quarantine supervision was under the control of a medical officer of the United States Army.

The port of Jolo is the center of the shipping interests for the islands of the Sulu group and of southern Mindanao. There is considerable traffic at all times between Jolo and the nearby islands of the Celebes group, also Borneo, Saigon, and Singapore. Quite a number of interisland steamers make Jolo a port of call, as do also a number of foreign vessels en route to and from other island ports. During the past year there were 43 entries from foreign ports, and a steady increase in the foreign trade has been observed. In addition to the above there are about 500 small sailboats ("sapits" or "Moro sailboats") whose headquarters are at Jolo, and these vessels ply between Jolo and the surrounding islands; in fact, they come in and go out, discharge and load cargo, and even go to and from many of the nearby foreign ports, carrying large numbers of passengers and valuable cargoes. These sail vessels, as well as the other vessels entering the port in the past, received very little sanitary supervision, only such as was possible and absolutely necessary, owing to the military status of the district and the exigencies of war.

Immediate action was taken to gradually obtain control over the many small Moro sailing craft. This, on account of the peculiar characteristics of the Moro, and in order to prevent antagonism on their part, was done with the greatest caution and in a manner to create the impression among them that the work done is for their benefit and is not compulsory. Should the measures become objectionable to them they would land their cargo and passengers at the nearest village and not come into the port of Jolo proper, and thereby all control over them would be lost.

Vessels entering this port between sunrise and sunset are now inspected immediately. The boarding so far has been done by means of a rowboat manned by two Filipino attendants.

An office was secured in the government building used as the custom-house. No furnishings for the office have as yet been obtained, although the collector of customs kindly loaned the Service sufficient furniture to conduct the office work until such as was necessary could be secured from Manila.

During the past four months the health conditions of the island of Jolo have greatly improved. The epidemic of cholera has almost entirely subsided. In the walled city, Jolo proper, there has been no cholera; all the cases occurred in the adjoining Moro villages.

The work instituted by the Service has progressed without friction or opposition from any quarter, and the Service enjoys the respect and support of both military and insular authorities. The importance of a station at Jolo can not be overestimated. Its proximity to the infected ports in the Celebes, the Dutch Indies, and Straits Settlements make the port a vital one, as through this port quarantinable diseases could quickly gain a foothold in the island of Jolo and the infection be rapidly disseminated to the other islands of the Philippine Archipelago by the hundreds of small boats which stop at every landing on the coasts of the adjoining islands. The primary infection of the cholera epidemic of 1882 was directly traced to Jolo and from there carried to the other islands and Manila by vessels.

During the two months much has been accomplished. The quarantine work has been placed on a rational and scientific basis. Masters, owners, and agents of vessels have been persuaded to adopt sanitary measures and to maintain their vessels in a better sanitary condition, not only when entering port but also throughout the voyage. The cooperation of the quarantine officers and customs inspectors at the ports of Siassi and Bongao has been obtained, and uniform regulations relative to the arrival and departure of interisland vessels prevail in the larger ports of the district. While but little quarantining and disinfecting of vessels was accomplished (only one vessel being disinfected), yet the work done and results obtained are gratifying when the existing conditions are taken into consideration.

The port of Jolo promises to be one of the principal gateways to the Philippines, and one of the most important ports. The fine harbor and the fact that vessels will soon be able to come directly alongside the wharves to load and discharge will no doubt cause every vessel coming from the south to make Jolo the first port of call. Thus, from a quarantine standpoint, Jolo will be the point for the detection of quarantinable diseases before the same have entered far into American territory.

The United States quarantine laws and regulations of 1903 were put into effect at this port on June 1, 1903.

The provisions of circular letters of June 21 and 22, issued by the chief quarantine officer for the Philippine Islands, were immediately put into force upon their receipt, although the provisions relative to mechanical cleanliness of vessels had already been in a measure carried out. No vessels were fumigated with sulphur to kill the rats and other vermin on board during May or June.

Every assistance possible has been given the customs authorities to regulate the Moro sailing craft, it being desired that these vessels be regularly enrolled (for which no charge is made) and that they carry "ship's papers" the same as other coastwise vessels. These measures have been successful to a degree, about 150 of the "sapits" being registered. The bearing of these regulations on sanitary matters is palpable, since the efficiency of the quarantine service in the archipelago must be in direct proportion to the measure of official control over the vessels which are engaged in the interisland traffic. Where vessels enter and clear at island ports an inspection and supervision is possible, but no control can be exercised over such as come and go when and where they like, many of them as far as Borneo, and all too swift to be overtaken even by ordinary steamers.

During the coming year the office must be furnished, and some disinfecting apparatus, autoclaves, bichloride pump, sulphur pots, etc., supplied for the use of the station. The only equipment so far at this station is the rowboat.

There are two attendants on duty at this station. They are the acting oarsmen who man the boarding boat. The advisability of sending the disinfecting barge

Proteccion from Cebu to Jolo as soon as the contemplated quarantine station at Cebu is finished is now under consideration.

The quarantine transactions for the month during which this station has been under Service control are shown in the tabulated statements.

Respectfully,

J. W. AMESSE,
Assistant Surgeon, in Temporary Command.

The following circular letters were issued during the year ended August 31, 1903:

[Circular letter.]

OFFICE OF THE CHIEF QUARANTINE OFFICER
FOR THE PHILIPPINE ISLANDS,
Manila, P. I., October 2, 1902.

The QUARANTINE OFFICERS,
Ports of Entry, P. I.

SIRS: I have to inform you that, in view of the fact that the plague and cholera epidemics have about subsided in Hongkong, I have allowed steerage passengers to come from Hongkong and Amoy without subjecting the vessel to quarantine on that account.

No modifications in the regulations have been made relative to vegetables and other products prohibited by regulations.

Respectfully,

J. C. PERRY,
*Passed Assistant Surgeon, U. S. P. H. and M. H. S.,
Chief Quarantine Officer for the Philippine Islands.*

[Circular letter.]

OFFICE OF THE CHIEF QUARANTINE OFFICER
FOR THE PHILIPPINE ISLANDS,
Manila, P. I., October 24, 1902.

The STEAMSHIP AGENTS,
Manila, P. I.

SIRS: I have the honor to inform you that vessels sailing from Hongkong on and after November 1, 1902, direct to Manila, will not be required to call at Mariveles unless there is sickness of a suspicious nature on board, but can come direct to Manila.

Vessels from Hongkong via Amoy, or Amoy, must call at Mariveles for disinfection.

Respectfully,

J. C. PERRY,
*Passed Assistant Surgeon, P. H. and M. H. S.,
Chief Quarantine Officer for the Philippine Islands.*

[Circular letter.]

OFFICE OF THE CHIEF QUARANTINE OFFICER
FOR THE PHILIPPINE ISLANDS,
Manila, P. I., February 3, 1903.

STEAMSHIP AGENTS AND OTHERS,
Manila, P. I.

SIRS: Owing to the improved conditions relative to cholera in Manila and immediate vicinity, and in view of the fact that most of the islands of the Archipelago either are or have been infected with this disease, the outgoing quarantine imposed on vessels sailing from this port to other places in the Philippine Islands is hereby provisionally raised, and until further notice vessels will be dispatched under the following conditions:

1. Vessels sailing for United States ports will not be subject to quarantine unless passengers are embarked from badly infected ports in the southern islands that have not completed five days since departure from such places. However, these vessels, in the event of taking a large number of steerage passengers, will be subject to inspection by the quarantine officers before a bill of health is granted.

2. Boats sailing for island ports will not be inspected unless sickness of a suspicious nature is on board among passengers or crew. Such vessels will secure a bill of health in the office of the chief quarantine officer, as was the custom before the establishment of the outgoing quarantine.

3. The captain or other responsible officer of the vessel will be required to make a declaration that no one in the personnel of his ship is sick, and in the event of having sickness of a suspicious nature on board, such vessel must be inspected before a bill of health will be granted, and the captain is required to immediately notify the quarantine officer of such an event.

4. Any captain, owner, or agent of a vessel making a false statement relative to the health of the crew and passengers on board, relative to the condition of his ship, or attempts to conceal sickness of a suspicious nature that might subject his ship to quarantine, will be prosecuted for each and every offense to the full extent of the law, which provides for heavy fine and imprisonment upon conviction.

5. This order goes into effect this date and will continue until further notice.

Respectfully,

J. C. PERRY,
*Passed Assistant Surgeon, P. H. and M. H. S.,
Chief Quarantine Officer for the Philippine Islands.*

[Circular letter.]

OFFICE OF THE CHIEF QUARANTINE OFFICER
FOR THE PHILIPPINE ISLANDS,
Manila, P. I., April 20, 1903.

THE STEAMSHIP AGENTS AND OTHERS,
Manila, P. I.

SIRS: You are hereby informed that it will be necessary for all vessels entering the port of Manila from any domestic port north of Corregidor to call at Mariveles for inspection.

It is not the intention to detain these vessels in quarantine unless there is actual sickness on board.

Respectfully,

VICTOR G. HEISER,
*Assistant Surgeon, Chief Quarantine Officer
for the Philippine Islands.*

[Circular letter.]

OFFICE OF THE CHIEF QUARANTINE OFFICER
FOR THE PHILIPPINE ISLANDS,
Manila, P. I., May 7, 1903.

THE STEAMSHIP AGENTS AND OTHERS,
Manila, P. I.

SIRS: Owing to the fact that cholera has again made its appearance in Manila in more or less virulent form, I have to inform you that until further notice it will be necessary before a bill of health can be issued to vessels bound for United States ports which carry steerage passengers that they go into strict quarantine for a period of five days, or if cholera develops, five days from the appearance of the last case. This includes the crew as well as passengers of all classes.

Respectfully,

VICTOR G. HEISER,
*Assistant Surgeon, Chief Quarantine Officer
for the Philippine Islands.*

[Circular letter.]

OFFICE OF THE CHIEF QUARANTINE OFFICER
FOR THE PHILIPPINE ISLANDS,
Manila, P. I., June 1, 1903.

The QUARANTINE OFFICERS,
Ports of Entry, P. I.

SIRS: Inclosed you will find copy of a letter sent to the governor and the collector of customs. You are directed to put the quarantine laws and regulations of 1903 in force, as suggested by the copy.

Respectfully,

VICTOR G. HEISER,
*Assistant Surgeon,
Chief Quarantine Officer for the Philippine Islands.*

[Inclosure.]

OFFICE OF THE CHIEF QUARANTINE OFFICER,
FOR THE PHILIPPINE ISLANDS,
Manila, P. I., June 1, 1903.

The COLLECTOR OF CUSTOMS FOR THE PHILIPPINE ARCHIPELAGO
Manila, P. I.

SIR: I have the honor to inclose herewith a copy of the new quarantine laws and regulations promulgated by the Secretary of the Treasury April 1, 1903. The same were put into force in Manila to-day, and will be effective at the other ports in the Philippines under the jurisdiction of this Service as soon as the respective officers can be supplied with a copy.

Respectfully,

VICTOR G. HEISER,
*Assistant Surgeon,
Chief Quarantine Officer for the Philippine Islands.*

[Circular letter.]

U. S. PUBLIC HEALTH AND MARINE-HOSPITAL SERVICE,
OFFICE CHIEF QUARANTINE OFFICER FOR PHILIPPINE ISLANDS,
Manila, P. I., June 4, 1903.

MEDICAL OFFICERS IN COMMAND,
U. S. PUBLIC HEALTH AND MARINE-HOSPITAL SERVICE,
Quarantine Stations, P. I.

SIRS: In the future you are directed to forward the reports "Weekly report, quarantine station," and "Weekly abstract bills of health" to this office in duplicate.

In this connection it is requested that due care be observed in the preparation of these reports, so that they may be of as much value as possible. The actual destination of the vessels should be stated, and not simply the name of your own port inserted regardless of where the vessel is bound.

Respectfully,

VICTOR G. HEISER,
*Assistant Surgeon,
Chief Quarantine Officer for the Philippine Islands.*

[Circular letter.]

U. S. PUBLIC HEALTH AND MARINE-HOSPITAL SERVICE,
OFFICE CHIEF QUARANTINE OFFICER FOR PHILIPPINE ISLANDS,
Manila, P. I., June 21, 1903.

MEDICAL OFFICERS IN COMMAND,
U. S. PUBLIC HEALTH AND MARINE-HOSPITAL SERVICE,
Philippine Island Ports.

SIRS: It has been the custom here to fumigate with sulphur all vessels which come from foreign ports or which carry cargo from foreign ports whenever the cargo or vessels have been exposed to plague infection or if it is not possible to certify that they have not been exposed to plague infection.

In order to make the practice uniform, you are directed to take the same action. You are directed to acknowledge receipt of this circular.

Respectfully,

VICTOR G. HEISER,
*Assistant Surgeon,
Chief Quarantine Officer for the Philippine Islands.*

[Circular letter.]

U. S. PUBLIC HEALTH AND MARINE-HOSPITAL SERVICE,
OFFICE CHIEF QUARANTINE OFFICER FOR PHILIPPINE ISLANDS,
Manila, P. I., June 22, 1903.

MEDICAL OFFICERS IN COMMAND,

U. S. PUBLIC HEALTH AND MARINE-HOSPITAL SERVICE,
Philippine Island Ports.

SIRS: You are hereby directed, before granting pratique to a vessel, to satisfy yourself, by a personal inspection, that the vessel is mechanically clean and in good sanitary condition.

Before a bill of health is issued, you will again satisfy yourself that the statements made therein are accurate. In the past, owing to the great pressure of work, occasioned by the many vessels that were actually infected, it is feared that it was not always possible to give this matter the attention that it merits. In order to cope successfully with disease, and more especially in a tropical climate, it is necessary to observe strict cleanliness. Experience has shown that the forecastles of many interisland boats are very dirty and insanitary.

The above directions are being strictly observed at this port, and it is desired to make the requirements at all ports under the jurisdiction of the Service uniform.

You are directed to acknowledge receipt of this letter.

Respectfully,

VICTOR G. HEISER,
Assistant Surgeon,
Chief Quarantine Officer for the Philippine Islands.

[Circular letter.]

U. S. PUBLIC HEALTH AND MARINE-HOSPITAL SERVICE.
OFFICE CHIEF QUARANTINE OFFICER FOR PHILIPPINE ISLANDS.
Manila, P. I., June 22, 1903.

MEDICAL OFFICERS IN COMMAND,

U. S. PUBLIC HEALTH AND MARINE-HOSPITAL SERVICE,
Philippine Island Ports.

SIRS: There is transmitted to you, under separate cover, Customs Decisions No. 4, Volume III, of April 30, 1903. On page 41, No. 86, you will observe that the United States Public Health and Marine-Hospital Service has been placed in charge of the medical inspection of arriving aliens. You are directed to commence this examination July 1, 1903. The same is to be conducted in accordance with the general rules and regulations promulgated by the Surgeon-General and approved by the Acting Secretary of the Treasury January 15, 1903.

It is expected that the necessary blanks and books required for this purpose will soon arrive, whereupon a supply will be sent you. In the meantime you are directed to keep an accurate record of the number of people examined and the number of certificates issued. The name, date, nationality, and the disease should be recorded in every certificate issued and a copy kept thereof. When such questions come up as are not covered by the regulations you are directed to submit the matter to this office for decision.

Respectfully,

VICTOR G. HEISER,
Assistant Surgeon,
Chief Quarantine Officer for the Philippine Islands.

[Circular letter.]

U. S. PUBLIC HEALTH AND MARINE-HOSPITAL SERVICE,
OFFICE CHIEF QUARANTINE OFFICER FOR PHILIPPINE ISLANDS,
Manila, P. I., July 7, 1903.

THE STEAMSHIP AGENTS AND OTHERS, *Manila, P. I.*

SIR: You are hereby informed that from this date it will not be necessary for vessels entering the port of Manila from domestic ports north of Corregidor to call at Mariveles for inspection.

This repeals the order issued by this office in circular letter dated April 20, 1903.

Respectfully,

VICTOR G. HEISER,
Assistant Surgeon,
Chief Quarantine Officer for the Philippine Islands.

Statistics of quarantine transactions at the port of Manila, P. I., for the year ended August 31, 1903.

INCOMING.

Month.	Vessels inspected from—		Number of vessels in quarantime.	Number of vessels disinfectcd.	Bills of health issued.	Pieces of baggage disinfectcd.	Baggage inspected and passed.
	Foreign ports.	Domestic ports.					
1902.							
September.....	51	160	19	18	224	2,541	46
October.....	56	283	3	20	300	4,675	1,081
November.....	74	260	4	10	321	3,423	624
December.....	64	326	8	4	353	1,923	406
1903.							
January.....	62	293	6	6	372	945	390
February.....	49	288	.....	4	356	862	894
March.....	71	387	.....	5	434	3,664	990
April.....	70	379	7	72	448	4,177	890
May.....	64	411	16	93	451	1,451	271
June.....	61	297	3	36	366	1,920	419
July.....	60	265	5	39	309	5,196	1,734
August.....	70	262	7	27	336	4,276	923
Total.....	752	3,611	78	334	4,270	35,053	8,658

Month.	Number of crew inspected.	Number of passen- gers inspected.		Number persons vaccinated.		Number of persons bathed and effects dis- infected.	Number of persons quaran- tined (suspects).
		Cabin.	Steerage.	Crew.	Passen- gers.		
1902.							
September.....	8,269	1,174	3,962	42	2	1,266	1,007
October.....	9,564	1,219	7,168	36	12	3,531	139
November.....	11,059	1,589	8,414	69	51	2,751	1,612
December.....	11,482	1,312	6,067	28	-----	632	28
1903.							
January.....	10,827	1,209	4,690	76	3	630	-----
February.....	10,784	1,094	5,796	26	8	511	-----
March.....	13,341	1,839	8,485	42	-----	903	-----
April.....	13,528	1,701	8,146	29	4	1,341	390
May.....	16,108	2,090	7,999	32	2	560	416
June.....	14,684	2,391	16,678	114	8	1,440	1,303
July.....	11,200	1,690	8,243	215	1,626	3,295	505
August.....	12,396	1,672	6,883	196	1,103	3,170	1,393
Total	143,242	18,980	92,531	905	2,819	20,030	6,793

OUTGOING.

Month.	Number of vessels inspected.	Number of vessels in quarantine.	Number of vessels disinfected.	Number of vessels recommended to Mari-veles.	Number of pieces baggage disinfected.	Pieces baggage inspected and passed.	Number crew inspected.	Number of crew quarantined.
1902.								
September.....	175	79	1	1	7,364	2,112	13,237	2,277
October.....	271	78	.....	2	4,203	478	14,280	2,101
November.....	281	48	1	5	4,712	1,089	10,223	1,621
December.....	309	50	.....	.....	7,445	2,007	12,205	1,367
1903.								
January.....	312	15	.....	.....	2,476	799	9,526	345
February.....	51	1	.....	.....	2,174	2,118	1,498	.....
May.....	35	1	31	.....	1,293	563	1,011	184
June.....	24	1	22	1	2,216	1,809	1,692	174
July.....	32	4	29	2	4,889	2,154	1,415	124
August.....	8	.....	8	.....	4,414	2,153	566	.....
Total.....	1,498	277	92	11	40,686	15,282	55,643	8,193

Statistics of quarantine transactions at the port of Manila, P. I., for the year ended August 31, 1903—Continued.

OUTGOING—Continued.

Month.	Number of passengers inspected.	Number passengers quarantined.		Number of persons vaccinated.	Persons bathed and clothing disinfected.	Cases quarantinable diseases among persons in quarantine.	
		Cabin.	Steerage.			Smallpox.	Cholera.
1902.							
September.....	10, 872	322	1, 460	.....	33	.....	1
October.....	14, 795	254	1, 994	.....	66	.....	2
November.....	9, 488	172	1, 724	.....	101	.....	8
December.....	14, 836	157	1, 786	.....	.....	.....	.....
1903.							
January.....	4, 059	18	19	.....	.....	.....	.....
February.....	1, 953	.....	.....	.....	.....	.....	.....
May.....	6, 941	106	1, 121	.....	436	.....	.....
June.....	6, 509	118	982	.....	618	.....	1
July.....	2, 144	190	2, 237	.....	2, 475	1	2
August.....	2, 063	.....	.....	923	2, 103	1	.....
Total.....	73, 660	1, 337	11, 323	923	5, 832	2	14

Summary of quarantine transactions at Manila, P. I., during the year ended August 31, 1903.

Total number of vessels inspected.....	5, 861
Total number of vessels detained in quarantine.....	355
Total number of vessels disinfected.....	244
Total number of vessels fumigated to kill rats.....	182
Total number of bills of health issued.....	4, 270
Total number of pieces of baggage disinfected.....	75, 739
Total number of pieces of baggage inspected and passed.....	23, 940
Total number of cases of quarantinable diseases detected on vessels:	
Cholera.....	115
Smallpox.....	7
Plague.....	2
Leprosy.....	6
Total number of crew detained in quarantine.....	11, 399
Total number of passengers detained in quarantine.....	16, 247
Total number of crew inspected.....	198, 885
Total number of passengers inspected.....	185, 171
Total number of persons vaccinated (including 2,220 residents of the village of Mariveles).....	4, 647
Total number of persons bathed and effects disinfected.....	25, 862
Total number of suspects and contacts quarantined at least five days at the Mariveles Quarantine Station.....	8, 973

Statistics of quarantine transactions at the port of Cebu, P. I., for the year ended August 31, 1903.

INCOMING.

Month.	Vessels inspected from—		Number of vessels in quarantine.	Number of vessels disinfected.	Bills of health issued.	Number of pieces of baggage disinfected.
	Foreign ports.	Domestic ports.				
1902.						
September	3	104	2	2	112	306
October	4	125	3	1	120	204
November	8	146	6	1	137	392
December	7	126	1	1	129	38
1903.						
January	5	118	.....	.....	125	.....
February	3	114	3	3	111	41
March	12	152	6	6	141	148
April	5	398	4	4	170	297
May	15	686	2	3	178	14
June	8	567	8	8	194	109
July	10	343	5	8	162	161
August	11	331	2	2	187	63
Total	91	3,210	42	39	1,766	1,873

Month.	Number of crew inspected.	Number of passengers inspected.		Number of persons held in quarantine.	Number of persons bathed and effects disinfected.	Number of crew and passengers vaccinated.
		Cabin.	Steorage.			
1902.						
September	2,769	118	618	79	79	.....
October	3,170	188	802	93	84	.....
November	3,787	188	896	238	58	.....
December	3,383	237	1,394	22	22	.....
1903.						
January	3,340	204	836	.....	.....	.....
February	3,276	142	717	32	37	.....
March	4,888	185	1,203	83	131	15
April	5,600	257	1,761	41	97	12
May	8,531	263	3,340	10	10	10
June	7,402	180	2,248	66	84	16
July	5,845	160	1,511	100	109	.....
August	5,757	145	1,491	45	45	72
Total	57,748	2,267	16,807	809	756	125

OUTGOING.

Month.	Number of vessels inspected.	Number of vessels in quarantine.	Number of vessels disinfected.	Number of pieces of baggage disinfected.	Pieces baggage inspected and passed.	Number of crew inspected.	Number of crew quarantined.
1902.							
September	145	68	2	233	135	6,804	1,477
October	148	68	.....	84	162	3,929	991
1903.							
July	319	158	2	57	.....	5,043	1,068
August	72	41	.....	.....	.....	856	384
Total	684	335	4	374	297	16,632	3,920

Statistics of quarantine transactions at the port of Cebu, P. I., for the year ended August 31, 1903—Continued.

OUTGOING—Continued.

Month.	Number of passengers inspected.	Number of passengers quarantined.		Number of persons vaccinated.	Persons bathed and clothing disinfected.	Cases of cholera on vessels.
		Cabin.	Steerage.			
1902.						
September.....	1,835	18	170			4
October.....	1,607	31	218			
1903.						
July.....	519	42	477		43	3
August.....	383		116		45	
Total.....	3,744	91	981		88	7

Summary of quarantine transactions at Cebu, P. I., during the year ended August 31, 1903.

Total number of vessels inspected.....	3,985
Total number of vessels held in quarantine.....	377
Total number of infected vessels disinfected.....	43
Total number of vessels fumigated to kill rats.....	11
Total number of bills of health issued.....	1,766
Total number of pieces of baggage disinfected.....	2,247
Total number of pieces of baggage inspected and passed.....	297
Total number of cases of quarantinable diseases detected on vessels:	
Cholera.....	46
Smallpox.....	3
Plague.....	
Leprosy.....	1
Total number of crew detained in quarantine.....	4,482
Total number of passengers detained in quarantine.....	1,319
Total number of crew inspected.....	74,380
Total number of passengers inspected.....	22,818
Total number of persons vaccinated.....	125
Total number of persons bathed and effects disinfected.....	844
Total number of suspects and contacts quarantined at least five days under observation.....	873

Statistics of quarantine transactions at the port of Iloilo, P. I., for the year ended August 31, 1903.

INCOMING.

Month.	Vessels inspected from—		Number vessels in quarantine.	Number of vessels disinfected.	Bills of health issued.	Number pieces baggage—	
	Foreign ports.	Domestic ports.				Disinfected.	Inspected and passed.
1902.							
September.....	9	197	13	2	258	286	417
October.....	2	202	6	2	185	156	68
November.....	1	195	5	1	166	22	184
December.....	4	243			252		
1903.							
January.....	1	114	2	2	82	200	78
February.....	4	33	1	1	42	75	
March.....	5	62			48		
April.....	4	44			40		
May.....	6	71			74		
June.....	7	56			97		
July.....	9	53			201	15	
August.....	12	213	3	4	327	78	
Total.....	64	1,483	30	12	1,772	832	747

Statistics of quarantine transactions at the port of Iloilo, P. I., for the year ended August 31, 1903—Continued.

INCOMING—Continued.

Month.	Number of crew inspected.	Number of passengers inspected.		Number persons held in quarantine.	Number of persons bathed and effects disinfected.	Number crew and passengers vaccinated.
		Cabin.	Steerage.			
1902.						
September	3,084	250	1,586	249	68	.....
October	2,593	195	1,911	209	126	.....
November	3,361	209	2,987	9	9	.....
December	3,548	243	2,825	.....	.....	.....
1903.						
January	2,604	273	851	141	141	.....
February	1,381	216	831	100	100	.....
March	2,111	298	701	.....	.....	.....
April	1,853	254	896	.....	.....	932
May	2,728	323	1,410	.....	.....	.....
June	2,371	329	629	.....	.....	.....
July	2,597	320	1,057	.....	.....	.....
August	4,690	263	1,817	54	54	.....
Total	32,921	3,173	17,501	762	498	932

OUTGOING.

Month.	Number of vessels inspected.	Number vessels in quarantine.	Number of vessels disinfected.	Number pieces baggage disinfected.	Pieces baggage inspected and passed.	Number crew inspected.
1902.						
September	201	109	11	638	1,796	4,329
October	192	9	3	267	1,173	1,771
November	171	8	1	58	107	2,619
December	121	1	1	52	3,366	3,333
Total	685	127	16	1,015	6,442	12,052

Month.	Number of crew quarantined.	Number passengers inspected.	Number passengers quarantined.		Number bathed and clothing disinfected.	Cases cholera on vessels.
			Cabin.	Steerage.		
1902.						
September	1,104	2,119	53	545	174	10
October	111	994	42	120	54	3
November	135	2,465	7	26	8	1
December	7	119	.....	.....	7	2
Total	1,357	5,697	102	691	243	16

Summary of quarantine transactions at Iloilo, P. I., during the year ended August 31, 1903.

Total number of vessels inspected	2,232
Total number of vessels held in quarantine	157
Total number of infected vessels disinfected	28
Total number of vessels fumigated to kill rats	7
Total number of bills of health issued	1,722
Total number of pieces of baggage disinfected	1,847
Total number of pieces of baggage inspected and passed	7,189
Total number of cases of quarantinable diseases detected on vessels:	
Cholera	28
Smallpox	2
Total number of crew detained in quarantine	1,737
Total number of passengers detained in quarantine	1,175
Total number of crew inspected	44,973
Total number of passengers inspected	26,371
Total number of persons vaccinated	932
Total number of persons bathed and effects disinfected	741
Total number of suspects and contacts quarantined at least five days under observation	868

Statistics of quarantine transactions at the port of Jolo, P. I., during the year ended August 31, 1903.

[Station opened May 6, 1903.]

Month.	Vessels inspected from—		Number of vessels disinfected.	Bills of health issued.	Number of crew inspected.	Number of passengers inspected.	
	Foreign ports.	Domestic ports.				Cabin.	Steerage.
1903.							
May	2	18	1	12	878	100	556
June	3	20	.....	15	902	64	371
July	3	32	1	36	1,057	120	479
August	7	41	.....	29	1,504	153	1,516
Total	15	111	2	92	4,341	437	2,922

Summary of quarantine transactions at Jolo, P. I., during the year ended August 31, 1903.

[Station opened May 6, 1903.]

Total number of vessels in quarantine	126
Total number of infected vessels disinfected	1
Total number of vessels fumigated to kill rats	1
Total number of bills of health issued	92
Total number of crew inspected	4,341
Total number of passengers inspected	3,359

FINANCIAL STATEMENT, QUARANTINE SERVICE IN THE PHILIPPINE ISLANDS.

I.—Appropriation account, insular treasurer, fiscal year 1903.

[United States currency.]

DEBITS.

To appropriation, act 430, quarantine service	\$26,940.66
To appropriation, act 490, quarantine service	24,440.00
To appropriation, act 595, quarantine service	53,141.00
Total debits	104,521.66

CREDITS.

By net withdrawals by disbursing officer	64,950.93
By amount credited insular purchasing agent	6,772.02
By amount credited bureau of printing	395.40
By balance unwithdrawn	32,403.31
Total credits	104,521.66

II.—Statement of funds (disbursing officer), appropriations of fiscal year 1902.

DEBITS.

1902.		
July	1. Balance June, 1902, account current	\$10,430.36
Aug.	9. Received from treasurer, A. W., 1769	1,430.10
1903.		
Apr.	11. Received from treasurer, A. W., 3013	160.72
Total debits		\$12,021.18

CREDITS.

1902.		
July	21. Refund to treasurer, receipt 5502	0.04
	21. Refund to treasurer, receipt 5503	2,511.04
	21. Refund to treasurer, receipt 5504	88.42
Sept.	13. Refund to treasurer, receipt 6411	1,699.66
	16. Refund to treasurer, receipt 6450	1,856.03
1903.		
Apr.	11. Balance to be accounted for by disbursements	5,865.99
Total credits		12,021.18

III.—Statement of funds (disbursing officer), appropriations of fiscal year 1903.

(United States currency.)

DEBITS.

1902.		
July	29. Received from treasurer, A. W. 1676	\$10,000.00
Aug.	27. Received from treasurer, A. W. 1795	6,000.00
Sept.	30. Received from treasurer, A. W. 1934	3,000.00
Oct.	30. Received from treasurer, A. W. 2058	7,500.00
Dec.	1. Received from treasurer, A. W. 2236	5,540.00
	31. Received from treasurer, A. W. 2397	4,000.00
1903.		
Jan.	26. Received from treasurer, A. W. 2483	13,000.00
Feb.	24. Received from treasurer, A. W. 2728	3,500.00
Mar.	24. Received from treasurer, A. W. 2926	4,000.00
Apr.	28. Received from treasurer, A. W. 3087	4,400.00
May	20. Received from treasurer, A. W. 3241	7,000.00
June	22. Received from treasurer, A. W. 3375	2,560.00
Total debits		<u>70,500.00</u>

CREDITS.

1902.		
Oct.	22. Refund to treasurer, receipt 7165	1,041.14
Nov.	6. Refund to treasurer, receipt 7432	369.43
1903.		
Jan.	16. Refund to treasurer, receipt 8653	460.37
June	30. Refund to treasurer, receipt 259	3,678.13
	30. Balance to be accounted for by disbursements	64,950.93
Total credits		<u>70,500.00</u>

Statement of funds to be accounted for by expenditures, July 1, 1902, to June 30, 1903.

Disbursements by disbursing officer, funds fiscal year 1902	\$5,865.99
Disbursements by disbursing officer, funds fiscal year 1903	64,950.93
Insular purchasing agent, supplies, funds fiscal year 1903	6,772.02
Bureau of public printing, printing, funds fiscal year 1903	395.40
Total disbursements	<u>77,984.34</u>

EXPENDITURES.

July, 1902:		
Launch and barge expenses, supplies, and repairs	\$82.50	
Station supplies and disinfectants	1,017.50	
		<u>1,100.00</u>
August, 1902:		
Compensation of personnel	5,059.22	
Office and general service expenses	519.29	
Launch and barge expenses, supplies, and repairs	252.06	
Station supplies and disinfectants	1,969.77	
New construction and new equipment	1,766.38	
		<u>9,566.72</u>
September, 1902:		
Compensation of personnel	2,491.58	
Office and general service expenses	579.03	
Launch and barge expenses, supplies, and repairs	195.06	
Station supplies and disinfectants	496.00	
New construction and new equipment	2,478.78	
		<u>6,240.45</u>
October, 1902:		
Compensation of personnel	3,537.89	
Office and general service expenses	385.89	
Launch and barge expenses, supplies, and repairs	655.62	
Station supplies and disinfectants	300.90	
		<u>4,880.30</u>

November, 1902:

Compensation of personnel.....	\$142. 95
Office and general service expenses.....	43. 51
Launch and barge expenses, supplies, and repairs.....	160. 37
Station supplies and disinfectants.....	299. 71
New construction and new equipment.....	1, 201. 05

\$1, 847. 59

December, 1902:

Compensation of personnel.....	6, 052. 92
Office and general service expenses.....	951. 14
Launch and barge expenses, supplies, and repairs.....	1, 432. 62
Station supplies and disinfectants.....	324. 16
New construction and new equipment.....	1, 715. 61

10, 476. 45

January, 1903:

Compensation of personnel.....	2, 946. 27
Office and general service expenses.....	537. 50
Launch and barge expenses, supplies, and repairs.....	1, 605. 74
Station supplies and disinfectants.....	290. 66
New construction and new equipment.....	2, 855. 32

8, 235. 49

February, 1903:

Compensation of personnel.....	2, 687. 67
Office and general service expenses.....	1, 061. 78
Launch and barge expenses, supplies, and repairs.....	197. 41
Station supplies and disinfectants.....	354. 69
Repairs to buildings and wharves.....	4, 498. 00

8, 799. 55

March, 1903:

Compensation of personnel.....	3, 447. 46
Office and general service expenses.....	754. 09
Launch and barge expenses, supplies, and repairs.....	159. 61
Station supplies and disinfectants.....	254. 96

4, 616. 12

April, 1903:

Compensation of personnel.....	3, 267. 90
Office and general service expenses.....	451. 64
Launch and barge expenses, supplies, and repairs.....	98. 09
Station supplies and disinfectants.....	348. 75
New construction and new equipment.....	160. 72

4, 327. 10

May, 1903:

Compensation of personnel.....	2, 443. 58
Office and general service expenses.....	636. 02
Launch and barge expenses, supplies, and repairs.....	248. 30
Station supplies and disinfectants.....	363. 15
Repairs to buildings and wharves.....	1, 911. 25

5, 602. 30

June, 1903:

Compensation of personnel.....	3, 043. 60
Printing blanks, books, and stationery.....	395. 40
Office and general service expenses.....	1, 048. 63
Launch and barge expenses, supplies, and repairs.....	3, 325. 44
Station supplies and disinfectants.....	3, 603. 10
Repairs to buildings and wharves.....	593. 87
New construction and new equipment.....	282. 23

12, 292. 27

Total expenditures..... 77, 984. 34

Total expenditures, quarantine service, in the Philippine Islands, July 1, 1902, to June 30, 1903.

DETAILS.

Compensation of personnel	\$35,121.04
Printing blanks, books, and stationery	395.40
Office and general service expenses	7,051.02
Launch and barge supplies and repairs	8,330.32
Station supplies and disinfectants	9,623.35
Repairs to buildings and wharves	7,003.12
New construction and new equipment	10,460.09
Total expenditures, United States currency	77,984.34

Expenditures by stations.

MANILA.

General service expenses	\$17,404.92
Launch expenses	8,391.49
New station equipment	199.10
	<u>\$25,995.51</u>

MARIVELES.

General service expenses and supplies	19,255.39
Repairs to buildings and wharves	7,003.12
New construction and new equipment	2,860.72
	<u>29,119.23</u>

ILOILO.

General service expenses	3,514.04
Launch and barge expenses	4,273.19
New station equipment	924.31
	<u>8,711.54</u>

CEBU.

General service expenses	3,614.13
Launch and barge expenses	2,910.21
New station equipment	7,113.35
	<u>13,637.69</u>

JOLO.

General service expenses	437.24
New station equipment	83.13
	<u>520.37</u>

Total expenditures, United States currency 77,984.34

Statement miscellaneous receipts.

[Expressed in United States currency.]

DEBITS.

1902.		
July.	Collections for subsistence at Mariveles Quarantine Station.....	\$32.50
Aug.	Collections for subsistence at Mariveles Quarantine Station.....	59.35
Sept.	Collections for subsistence at Mariveles Quarantine Station.....	32.00
Oct.	Collections for subsistence at Mariveles Quarantine Station.....	46.00
Nov.	Collections for subsistence at Mariveles Quarantine Station.....	51.50
Dec.	Collections for subsistence at Mariveles Quarantine Station.....	60.00
1903.		
Jan.	Collections for subsistence at Mariveles Quarantine Station.....	62.00
Feb.	Refund Hongkong and Shanghai Bank, excess deposit account ...	1.50
	Collections for subsistence at Mariveles Quarantine Station.....	57.50
Mar.	Collections for subsistence at Mariveles Quarantine Station.....	56.00
Apr.	Collections for subsistence at Mariveles Quarantine Station.....	62.00
May.	Collections for subsistence at Mariveles Quarantine Station.....	47.00
June.	Collections for subsistence at Mariveles Quarantine Station.....	93.00
	Total debits.....	<u>660.35</u>

CREDITS.

1902.		
July	21. Deposit insular treasurer, receipt 5503.....	\$32. 50
Aug.	28. Deposit insular treasurer, receipt 6180.....	40. 55
	28. Deposit insular treasurer, receipt 6181.....	18. 80
Sept.	11. Deposit insular treasurer, receipt 6427.....	9. 00
	28. Deposit insular treasurer, receipt 6449.....	23. 00
Oct.	11. Deposit insular treasurer, receipt 6999.....	7. 50
	15. Deposit insular treasurer, receipt 7000.....	38. 50
Nov.	11. Deposit insular treasurer, receipt 7500.....	51. 50
Dec.	8. Deposit insular treasurer, receipt 7991.....	60. 00
1903.		
Jan.	16. Deposit insular treasurer, receipt 8852.....	62. 00
Feb.	20. Deposit insular treasurer, receipt 9251.....	59. 00
Mar.	14. Deposit insular treasurer, receipt 9652.....	56. 00
Apr.	7. Deposit insular treasurer, receipt 10058.....	62. 00
May	20. Deposit insular treasurer, receipt 10834.....	47. 00
June	9. Deposit insular treasurer, receipt 11278.....	46. 50
	27. Deposit insular treasurer, receipt 11672.....	46. 50
Total credits		660. 35

Statement of appropriations and expenditures for the quarantine service in the Philippine Islands from July 1, 1902, to August 31, 1903, United States currency.

Quarantine service (acts 430, 490, and 595).	Appropriations.	Expenditures.
Fiscal year 1903:		
Salaries and wages	\$40,061.66	\$35,025.41
Transportation.....	17,500.00	10,449.19
Commutation for quarters	6,075.00	4,940.32
Support Mariveles Quarantine Station	30,278.62	14,406.22
Contingent expenses	9,706.38	6,901.81
Printing and binding.....	900.00	395.40
Total.....	104,521.66	72,118.35

\$4,000.58 retained against outstanding obligations, uncompleted contracts, repairs, and traveling expenses.

Total appropriated, funds fiscal year 1903 \$104,521.66
Total expended, funds fiscal year 1903 72,118.35

Second page of statement of appropriations and expenditures for the quarantine service in the Philippine Islands from July 1, 1902, to August 31, 1903, United States currency.

Quarantine service (acts 807 and 831).	Appropriations.	Expenditures.
Fiscal year 1904:		
Salaries and wages	\$19,900.00	\$5,161.38
Transportation.....	5,300.00	38.83
Commutation for quarters.....	1,590.00	.....
Support Mariveles Quarantine Station	12,620.00	412.11
Contingent expenses	3,390.00	124.55
Quarantine station, Cebu	30,000.00	.....
Launch	4,000.00	.....
Total.....	76,800.00	5,736.87

Total appropriated, first half fiscal year 1904..... \$76,800.00
Total expended, July and August, 1903..... 5,736.87

Respectfully submitted.

VICTOR G. HEISER,
Assistant Surgeon,
Chief Quarantine Officer for the Philippine Islands.

The SECRETARY OF THE INTERIOR, Manila, P. I.

APPENDIX C.

REPORT OF OFFICER IN CHARGE PHILIPPINE CIVIL HOSPITAL.

PHILIPPINE CIVIL HOSPITAL,
Manila, September 15, 1903.

SIR: I have the honor to report the second year's work of this bureau as follows:

Since the last report there have been many important additions to the Philippine Civil Hospital in its equipment, its arrangement, and its personnel. There has been a greater call upon its capacity than was originally expected, owing largely to the fact that the Woman's Hospital was closed and the intended cosmopolitan hospital was never opened. This condition of affairs necessitated the throwing open of the doors of the civil hospital for the care of not only the families of army officers, but of all who applied for treatment and care in the city of Manila and from the provinces. All emergency cases presented were attended to, and those in need of hospital accommodations were admitted.

On June 1, 1903, the position of assistant attending physician and surgeon was abolished, it being deemed best for the service to have an additional house surgeon who would be on duty in the hospital to answer ambulance calls and relieve the other house surgeon. Since this time the work has been continued by the attending physician and surgeon and house surgeon, it not having been possible to secure the additional house surgeon immediately. At the same time there was also added three nurses, and the number of attendants was reduced to nine.

The personnel of the Philippine Civil Hospital consists of the attending physician and surgeon, 2 house surgeons, chief nurse, matron, dietist, 14 nurses, 9 attendants, superintendent, 2 clerks, 1 interpreter, 2 ambulance drivers, 4 cooks, and 27 native servants.

Summary report of patients treated.

Number of civil employees, pay patients	1,075
Number of civil employees, free patients	536
Number of private patients	204
Number of emergency cases	100
Total number	1,915

Included in the above are 92 cases treated by outside physicians.

Classification as to departments of the civil government.

Agriculture	14	Fire	43
Architecture	7	Geological survey	1
Attorney-general's office	8	Insular cold-storage and ice plant	29
Auditor's	38	Insular purchasing agent	56
Assessors and collectors	7	Internal revenue	6
Benguet road	5	Improvements of port	7
Bilibid prison	13	Justice	12
Board of health	57	Government laboratories	13
Building and illumination	1	Light-house construction	3
Customs	128	Land registration	2
City engineer	12	Museum	1
Civil hospital	19	Municipal board	6
Coast guard and transportation	20	Police	439
Captains of port	5	Posts	51
Philippine civil-service board	4	Provincial government	2
Coast and geodetic survey	4	Philippine Civil Commission	4
Census	2	Public printing	35
Executive bureau	26	Public lands	1
Engineering and public works	22	Streets, parks, etc	91
Exposition board	1	Secret service	14
Educational	164	Treasury	17
Ethnological survey	3	Water and sewers	1
Forestry	10	Philippine constabulary	207

The total number of patients seen and prescribed for who did not enter hospital was 4,315. The number of days spent in hospital by all patients is 23,249, or about 21,000 by civil employees and emergency patients. The number of visits made in hospital by officers of this bureau is 42,000. The number of visits outside to civil employees, including those who called at office for examination and prescriptions, is 19,680. The number of cases treated in hospital, dispensary, and quarters is 6,230. The number of surgical cases in hospital, 893. The number of surgical dressings, 9,125. The percentage of deaths of civil employees (officers and families), emergency cases, and charity patients treated by officers of this bureau is about 2½ per cent. Deducting 13 cases who were in a dying condition when admitted to hospital, makes an average of about 1½ per cent. There were 6,393 prescriptions filled at the hospital dispensary during the year, and drugs and medicines, in small lots, have been furnished to various bureaus, particularly the educational and forestry bureaus, for use throughout the provinces.

Medical cases.

Diagnosis.	Number treated.	Diagnosis.	Number treated.
Abortion	2	Catarrh:	
Threatened	1	Nasal	2
Albuminuria	1	Chronic gastric	2
Alcoholism:		Chronic intestinal	2
Acute	29	Cephalgia	13
Chronic	2	Chloral poisoning	1
Anæmia, tropical	1	Chloroform poisoning	1
Aneurism, transverse aorta	1	Cholera, Asiatic, convalescent	4
Angina pectoris	1	Cholera suspects	16
Ankylostomiasis	11	Cholera morbus	4
Anthraxis	2	Colic:	
Gonorrhœal	3	Hepatic	1
Ascariasis	7	Intestinal	22
Asthma	11	Renal	4
Beriberi	27	Confinement	27
Bronchitis:		Congestion of lungs	1
Acute	57	Conjunctivitis:	
Chronic	3	Acute catarrhal	11
Bubonic plague	1	Purulent	4

Medical cases—Continued.

Diagnosis.	Number treated.	Diagnosis.	Number treated.
Conjunctivitis—Continued.		Mercurial poisoning	2
Pustular	2	Miscarriage	3
Rheumatic	1	Morphinism	2
Traumatic	2	Myalgia	1
Constipation	25	Nephritis:	
Coryza	5	Acute	6
Coxalgia	12	Chronic interstitial	4
Cystitis	1	Chronic parenchymatosis	6
Dementia, alcoholic	1	Nervous prostration	6
Dermatitis, venemata	1	Neuralgia	6
Dengue	99	Neurasthenia	28
Diarrhea:		Neuritis	8
Acute	47	Odontalgia	1
Chronic	5	Œdema of eyelid	1
Dhobie itch	28	Œdema of lungs	4
Dilatation of heart	1	Opacity of cornea	3
Dysentery:		Opacity of vitreous humor	1
Amœbic	77	Orchitis:	
Catarrhal	75	Gonorrhœal	50
Chronic	9	Traumatic	1
Malignant ulcerative	2	Otitis media:	
Eclampsia	2	Acute catarrhal	10
Eczema	2	Suppurative	5
Endocarditis, malignant ulcerative	1	Ovaritis	3
Endometritis:		Pemphigus	2
Acute	4	Peritonitis:	
Chronic	1	General	1
Septic	1	Local	1
Subacute	2	Pelvic	1
Enteric fever	10	Pharyngitis	1
Enterocolitis	11	Pleurisy:	
Epididymitis	1	With effusion	1
Epilepsy	1	Plastic	4
Fecal impaction	2	Pneumonia:	
Fatty degeneration of the heart	2	Broncho	9
Febricula	38	Lobar	2
Gastralgia	8	Traumatic	2
Gastritis:		Proctitis	1
Acute	36	Pruritus	2
Chronic	12	Pseudo-angina pectoris	1
Gastro-enteritis, acute	12	Ptomaine poisoning	9
Gonorrhœa	55	Pyæmia	2
Gout	1	Pyelitis	5
Hæmoptysis	1	Pyosalpinx	1
Heat exhaustion	3	Regurgitation:	
Hemiparesis	2	Aortic	1
Hepatitis, acute	11	Mitral	1
Hysteria	1	Pulmonary	1
Indigestion:		Rheumatism:	
Gastric	10	Acute articular	4
Intestinal	11	Chronic	10
Influenza	4	Muscular	19
Inhalation of poisonous gas	1	Salpingitis	1
Insanity, delusional	3	Sciatica	1
Insomnia	1	Septicæmia	1
Intussusception	1	Sprue	2
Iritis:		Stenosis, aortic	1
Acute plastic	5	Syncope	3
Rheumatic	1	Syphilis:	
Syphilitic	2	Primary	15
Jaundice	7	Secondary	9
Keratitis	1	Tertiary	2
Laryngitis:		Tachycardia	1
Acute catarrhal	5	Tænia	3
Chronic catarrhal	1	Tonsillitis	4
Tubercular	1	Trachoma	3
Lumbago	6	Trichocephalus dispar	5
Malaria cachexia	6	Tuberculosis:	
Malaria fever:		Acute pulmonary	5
Æstivo autumnal	95	Chronic pulmonary	19
Tertian intermittent	61	Intestinal	3
Malingers	6	Glands of neck	2
Mania, acute alcoholic	3	Ulcer of stomach	2
Marasmus	1	Urethritis, nonspecific	2
Measles	2	Varicella	4
Melancholia	2	Vertigo	1
Meningitis:		Vomiting of pregnancy	4
Cerebral	2	Undetermined	10
Spinal	1		

The instruments and furniture for the operating rooms were duly received, and at the present time the Civil Hospital has as complete an equipment as could be desired. The arrival of a modern ambulance and the installation of the police and fire-alarm system has allowed the arranging of the ambulance stables in the same fashion as the fire department. The stables are fitted with an indicator, drop harness, and chains. The horses are trained as are the fire department horses. Such arrangement places the ambulances within ten or fifteen minutes from any part of the city of Manila. To the courtesy and kindness of Chief Hugh Bonner, of the fire department, we are indebted for the training of our horses and the installation of the indicator.

The various members of the medical profession of the city of Manila have availed themselves of the privilege of placing their patients in the Civil Hospital, and within the past year there have been in the Civil Hospital 92 medical and surgical cases treated by physicians other than its staff, with 7 deaths.

The treatment for dysentery appears to prove almost satisfactory. There have been no deaths from malaria or dengue, and but one by typhoid. In comparing cases of dysentery, we find that the amoebic variety occurs with greatest frequency between the ages of 25 and 30. Malarial fever is far more common among whites than natives. Tuberculosis is relatively four times more common among natives than whites. Bronchitis occurs in natives almost ten times more frequently than among whites. Asthma is more frequent among natives, in ratio of 6 to 1. Dysentery among whites amounts to 85 per cent; natives, 15 per cent. It is most frequent in September and least frequent in May. Sixty-one per cent of the malaria has been of the aestivo-autumnal variety.

Operations in the Tropics appear to be quite successful, and the usual care in antisepsis seems to produce the same results in conditions of operating wounds as in temperate zones. Attention is invited to the fact that operations have been performed for nine cases of abscesses of the liver since the opening of this hospital, including five this year, with no deaths. The work in the surgical department has been almost quadruple in number of cases compared with those of last year, and the medical cases have increased very materially.

Surgical cases.

Diagnosis.	Number treated.	Diagnosis.	Number treated.
Abrasion:		Abscess—Continued.	
Cornea, traumatic	2	Gluteal region—	
Left knee	2	Left	3
Right leg	3	Right	1
Abscess:		Hand	3
Abdomen, lower part	1	Head	1
Ankle, right	1	Inguinal region	1
Arm	1	Knee	2
Axilla	6	Leg	4
Breast	1	Liver	5
Back	1	Lumbar region, left	1
Buttock	8	Maxilla—	
Cornea	1	Left, upper	1
Ear	5	Right, lower	1
Face	3	Mouth, right	1
Finger	1	Neck	6
Foot	4	Ovary	1
Forearm—		Penis	1
Left	3	Perineal	1
Right	1	Perirectal	1
Forehead	11	Periurethral	1

Surgical cases—Continued.

Diagnosis.	Number treated.	Diagnosis.	Number treated.
Abcess—Continued.		Fractures:	
Rectal	1	Clavicle, right	1
Sacrum	1	Femur	4
Scapular region, right	1	Finger	3
Scrotum	1	Frontal bone	1
Shoulder	1	Innominate right, bullet	1
Thigh	1	Maxilla, left superior	1
Urethral	3	Nose	4
Various other locations	3	Radius	1
Wrist	2	Skull	2
Amputations:		Spinal, vertebral	2
Finger	15	Tibia and fibula	2
Hand	3	Furunculosis	9
Toes	8	Gallstone	2
Thigh	2	Ganglion, wrist	2
Appendicitis:		Hemiplegia	3
Catarrhal	13	Hemorrhage:	
Gangrenous	1	Of bladder	1
Suppurative	4	Cerebral	1
Aspiration of liver	5	Hemorrhoids	31
Balanitis	1	Hernia:	
Bubo	38	Inguinal	3
Burns:		Femoral	1
Chemical	1	Herpes, penis	1
Fire	23	Hordeolum	4
Lime	5	Hydrocele	3
Powder	1	Ingrowing toenails	6
Steam	2	Lipoma:	
Bursitis	3	Left deltoid region	1
Carbuncle:		Left ankle	1
Left ankle	2	Necrosis of superior maxilla	1
Left arm	1	Ostitis, left femur	1
Left chin	1	Papilloma	1
Left elbow	1	Paraphimosis	1
Left face	1	Pannus	1
Left deltoid region	1	Periostitis:	
Neck	1	Left tibia	1
Thorax	1	Left femur	1
Caries of outer angle of orbit	1	Plastic operation on eyelid	1
Cataract, double	2	Plastic operation on nose	1
Cellulitis	9	Polypus, nasal	1
Left arm	1	Pregnancy, tubal, with rupture	1
Traumatic, left face and forehead	1	Prostatitis	2
Chalazion	1	Prolapse of uterus	1
Chancroid	29	Pterygium	4
Circumcision	12	Retention of urine	1
Concussion of brain	1	Sarcoma:	
Contusions:		Breast	1
Abdomen	1	Left orbit	1
Back	2	Spina bifida	1
Chest	2	Sprain:	
Cornea	1	Ankle, left	1
Eye	1	Finger	5
Face	1	Metatarsal ligaments	2
Foot	7	Quadratus lumborum muscle	1
Corns	3	Spinal ligaments	1
Crushed hand	1	Toe, great	1
Crushed toe	5	Wrist	9
Crushed thumb	3	Stricture of rectum	1
Crushed finger	6	Staphyloma	2
Curettage, uterus	8	Sting of insect:	
Cyst:		Forearm	1
Finger	1	Right hand	1
Ovarian, right	1	Subinvolution of uterus	1
Sebaceous, face	2	Synovitis, left ankle	1
Dislocations:		Tenosynovitis of fingers	1
Index finger, left	1	Torticollis	1
Hip joint, right	2	Tumor of brain—cerebral syphilis	1
Humerus, right subclavicular	1	Ulcer, tropical	16
Radius	1	Ulcer of—	
Wrist	1	Cornea	3
Displacement of uterus, retro	1	Foot	2
Epistaxis	1	Finger	1
Epithelioma:		Knee	3
Lower lip	1	Leg	7
Rectum	1	Rectum	1
Exostosis, nasal	1	Uterus	1
Felon	10	Vaccinations	36
Fistula in ano	13	Varicocele	3
Foreign body in pharynx	1	Vernuca	1
Foreign body in cornea	1		

Surgical cases—Continued.

Diagnosis.	Number treated.	Diagnosis.	Number treated.
Wounds:		Wounds—Continued.	
Contused—		Incised—Continued.	
Abdomen	2	Larynx	1
Cheek	3	Leg	1
Chest	4	Lip	1
Eye	1	Thigh	5
Foot	5	Thorax	6
Forearm	1	Infected—	
Groin	1	Elbow	1
Head	4	Face	1
Leg	5	Finger	16
Sacrum	1	Foot	23
Toe	2	Hand	16
Thumb	1	Knee	10
Contused and lacerated—		Leg	9
Finger	2	Toe	9
Foot	3	Lacerated—	
Forehead	1	Arm	1
Head	1	Axilla	1
Thigh	1	Cervix	2
Gunshot—		Eyelid	4
Arm	1	Face	3
Arm and forearm	1	Finger	18
Forearm	1	Forearm	1
Hand	1	Forehead	5
Head	1	Foot	3
Leg	2	Hand	4
Shoulder	1	Knee	1
Thigh	4	Leg	5
Incised—		Lip	5
Abdomen	3	Neck	1
Arm	1	Perineum	1
Breast	1	Scalp	16
Cheek	7	Thigh	2
Eyelid	2	Punctured—	
Finger	16	Toe	1
Foot	7	Arm	1
Forearm	5	Cheek	1
Forehead	4	Forehead	1
Groin	4	Foot	1
Hand	8	Heel	1
Head	4	Thigh	1

Deaths.

Diagnosis.	Number.	Diagnosis.	Number.
Alcoholism, acute	3	Gunshot wound, suicide	1
Apoplexy	1	Meningitis, cerebral	1
Abortion	1	Mercurial poisoning	1
Bubonic plague	1	Morphin, poisoning	1
Burns	2	Nephritis, chronic, interstitial	1
Catarrh of stomach and intestines	1	Oedema of lungs	2
Dilatation of heart	1	Peritonitis, general	1
Dysentery:		Pneumonia, lobar	1
Amoebic	3	Pyæmia	2
Chronic	2	Septicæmia	1
Malignant, ulcerative	1	Spina bifida	1
Eclampsia	2	Syphilis, gumma of brain	1
Endocarditis	1	Tuberculosis:	
Enteric fever	3	Acute pulmonary	1
Fatty degeneration of heart	2	Chronic	1
Fracture of femur	2	Intestinal	1
Fracture of skull	2		
Gallstones	2	Total number of deaths	47

The grounds of the hospital have been greatly improved. The cottage at the left of the entrance to the hospital has been connected with the main building by a covered walk, and is used exclusively as a woman's pavilion. The quarters formerly occupied by the nurses, proving both inconvenient and inadequate, a building directly opposite the hospital grounds was leased for this purpose. The new quarters are much more convenient, cool, and sanitary.

The faithful and untiring work of the nurses and attendants is especially commended. They were very frequently called upon to not only perform double duty, but to serve many hours overtime. This will be appreciated when the enervating effect of this climate and the insistent character of the work is considered. With the full complement of nurses present, and the starting of a nurses' training school, together with student attendants, the work of the hospital will not prove so trying to all the employees as it has been in the past year. I take great pleasure in commending the faithful and earnest work of Dr. J. H. Williams, the senior house surgeon, and the earnest and accurate work of the superintendent, Mr. L. B. Alexander.

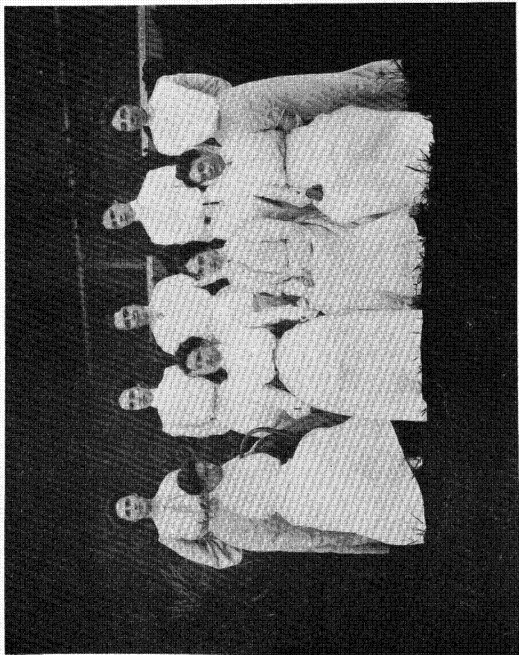
I respectfully recommend the erection of a new modern hospital with a capacity of 500 beds and 40 private rooms, with separate houses for nurses and attendants, the nurses' home to be so arranged that there may be sufficient room for the accommodation of student nurses, and an allowance made in connection with the attendants' quarters for the assistant attendants; in connection with the hospital building, but separate and distinct, the erection of a medical school consisting of an amphitheater for lectures, dissecting rooms, students' laboratories, etc. The main hospital should have an operating amphitheater containing surgeons' dressing room, anæsthetising, septic, and six or eight separate rooms for the accommodation of those recovering from anæsthetics. A separate maternity ward with a confinement room attached should be provided.

I respectfully recommend the location of this hospital on the bay shore at Cuartel Malate, which would give the advantage of the sea air. A two-story building, with bridge across Calle Real, erected opposite the Cuartel, with sea wall, pier, and roof garden, would be particularly desirable. This is nearly a central location and close enough to the government laboratories for the use of the electricity from its power plant, and yet far enough away to avoid possible infection from visiting flies and mosquitoes, etc. Either this location or on Santa Mesa Heights behind the city, where plenty of ground and the elevation insure greater coolness than the city proper.

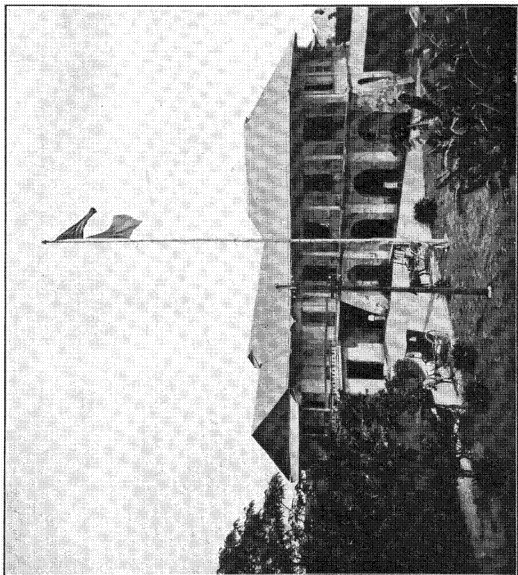
Very respectfully,

H. EUGENE STAFFORD,
*Attending Physician and Surgeon
Civil Officers and Employees.*

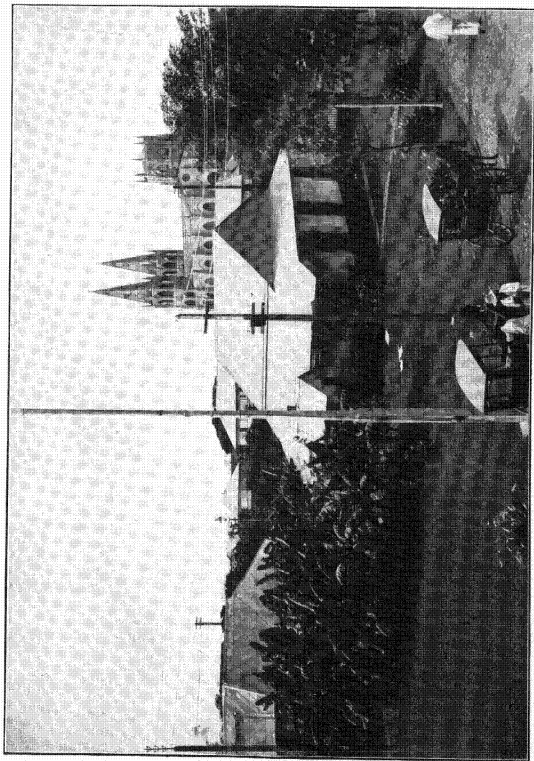
The SECRETARY OF THE INTERIOR,
Manila, P. I.



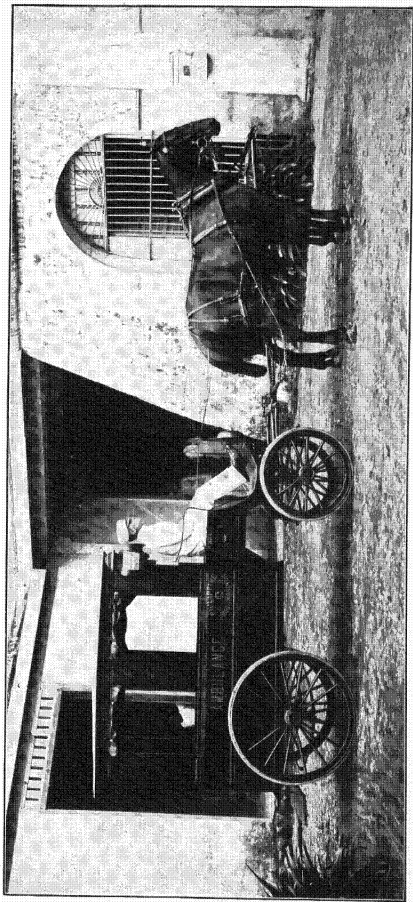
GROUP OF NURSES, CIVIL HOSPITAL.



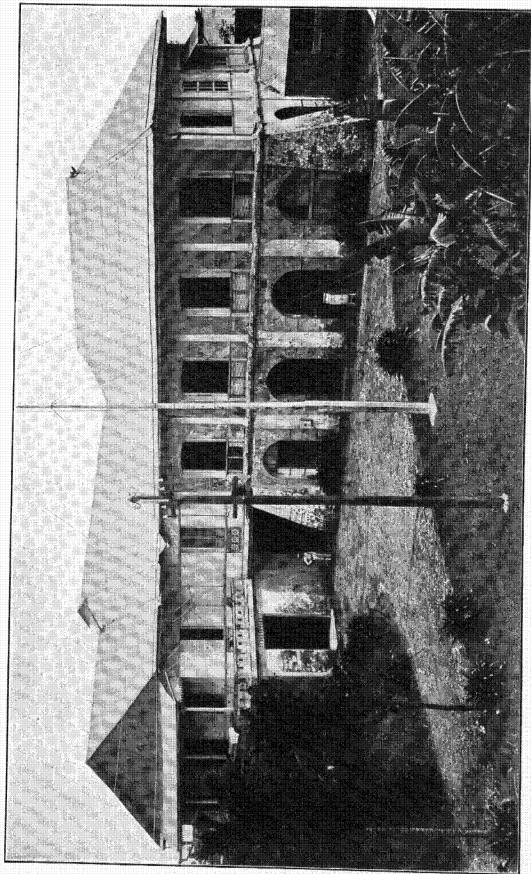
FRONT VIEW, CIVIL HOSPITAL.



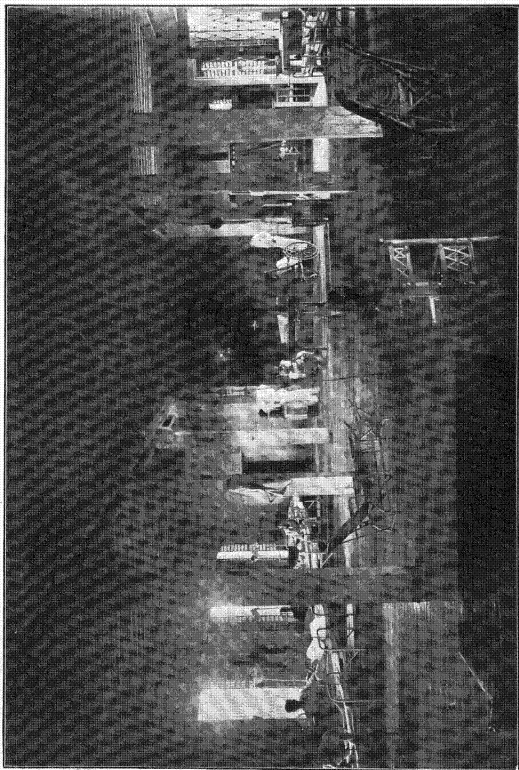
LOOKING SOUTH FROM CIVIL HOSPITAL



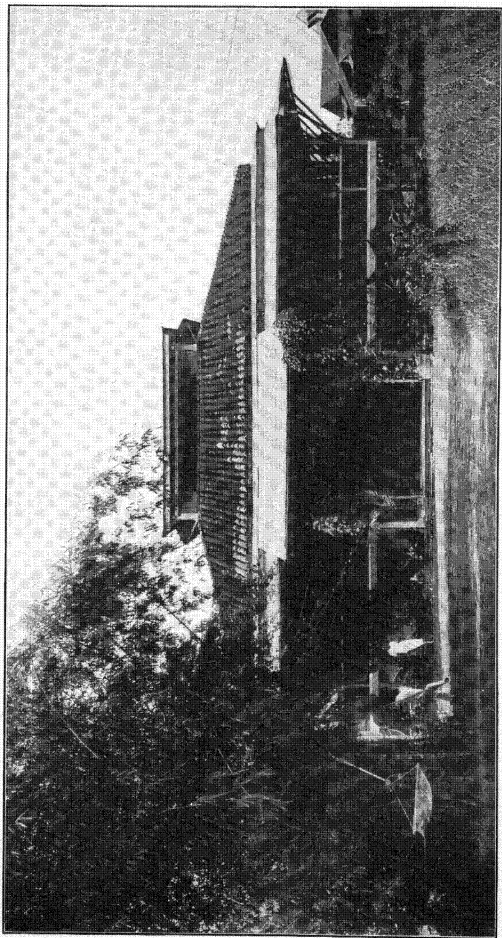
AMBULANCE NO. 2, CIVIL HOSPITAL.



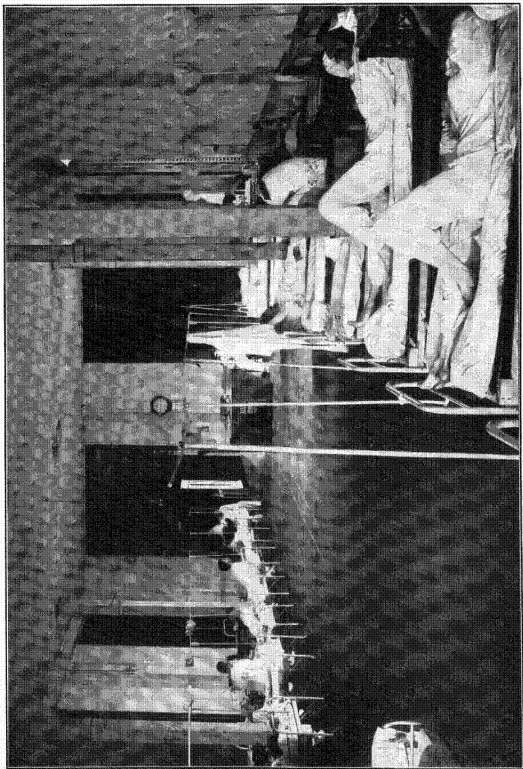
FRONT VIEW, CIVIL HOSPITAL.



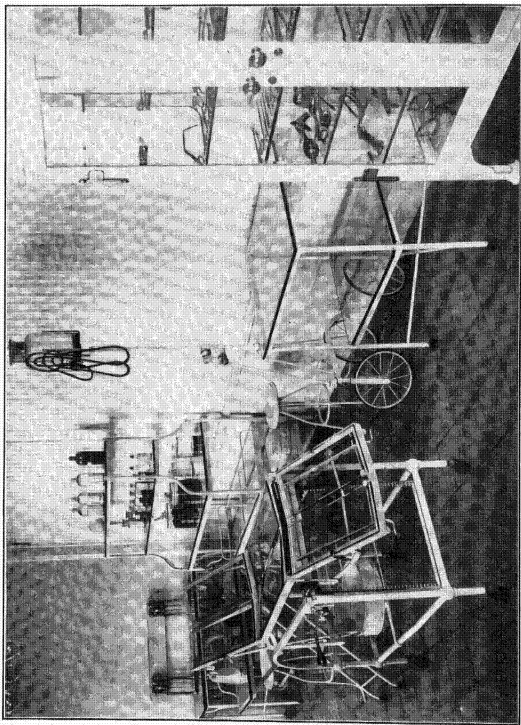
INTERIOR VIEW, WARD NO. 3, CIVIL HOSPITAL



FEMALE NURSES' QUARTERS, CIVIL HOSPITAL.



WARD NO. 1, CIVIL HOSPITAL.



OPERATING ROOM, CIVIL HOSPITAL

APPENDIX D.

REPORT OF THE ACTING ATTENDING PHYSICIAN IN CHARGE OF THE CIVIL SANITARIUM.

DEPARTMENT OF THE INTERIOR,
CIVIL SANITARIUM,

Baguio, Benguet, P. I., September 1, 1903.

SIR: I have the honor to submit the annual report of the civil sanitarium, Benguet, from September 1, 1902, to August 31, 1903.

Since the earliest date of the American occupation in the Philippines it has been evident that some provision would be necessary for rest and change of climate for those carrying on the work of the government. The climate of Benguet Province was brought to the notice of the United States Philippine Commission, and Commissioners Wright and Worcester were detailed to investigate this portion of Luzon with the view of considering the advisability of establishing a station in a suitable place. The result of their visit was the purchase of the property of Otto Sherer, a native house and a small piece of land in the village of Baguio, which formed the nucleus for the new system of buildings which were soon to be constructed by the government.

The selection of location is a most happy one, as Baguio is situated about 5,000 feet above the sea level. It is surrounded by most beautiful mountainous country, and has a climate that is cool and invigorating. The change from the heat of Manila is complete, and the pure pine-scented air proves most beneficial to convalescents and those who desire to recuperate from the effects of the enervating climate of the lowlands. Within a few months from the present date a fine road which is being constructed by the government between Dagupan and Baguio will be completed, thus affording easy and comparatively rapid transportation from Manila. The country is well adapted to out-of-door exercise, the different mountain trails furnishing opportunity for horseback riding and walking. The country and climate are admirably suited to golf, but as yet no links have been laid out. With the expenditure of 5,000 pesos (approximately) for the making of grounds, the patients and guests of Baguio would be able to enjoy one of the most pleasurable and beneficial outdoor pastimes.

Since the last annual report, September 1, 1902, was submitted, many improvements have made on the property acquired by the government here. The sanitarium building was completed in November, 1902, and furnished during the three or four months that followed. The grounds around the building have been greatly beautified with flower gardens, fern rockeries, paths, terraces, etc. Directly in front of the sanitarium, in the valley (or swamp) an artificial lake has been constructed. A very good tennis court occupies the space just south of the building. Five cottages have been completed for the use of

families. They are situated at a convenient distance from the sanitarium building.

The addition of the improved telephone system, which was later changed to a telegraph system, has greatly facilitated communication between the sanitarium and Manila.

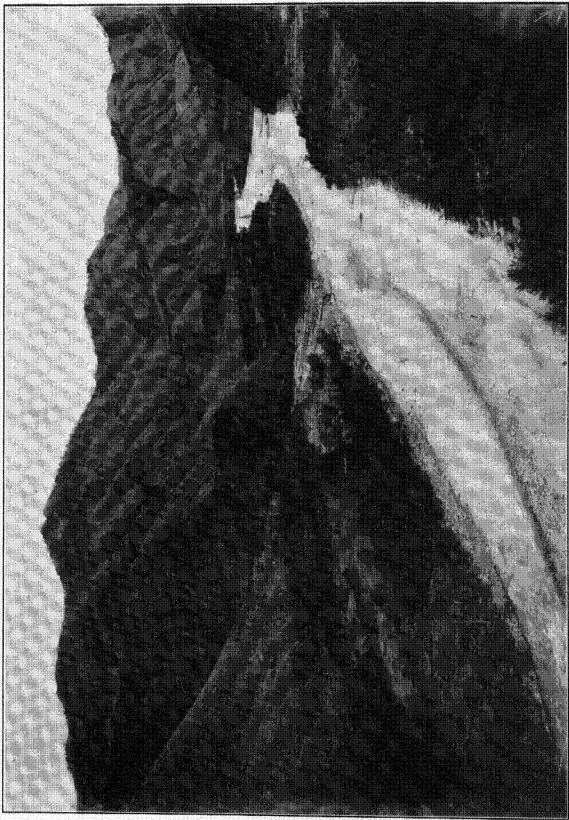
During the month of May the seat of government was moved from Manila to Baguio, thus bringing the little Igorrote village into prominence. Cottages 2, 3, and 4 were occupied by the families of government officials, while cottage 1 was used as an annex to the sanitarium, and cottage 5 served as office room for the work of the Civil Commission.

It was clearly demonstrated that Baguio is growing in the appreciation of the American people in the Philippines. At all times during the season the sanitarium was overcrowded with patients and guests. The addition of the various secretaries and clerks of the Commission, together with the large number of guests, proved the necessity of providing more commodious accommodations before another season. The housekeeping arrangement, too, would be greatly improved and facilitated by the addition of a steward or an experienced housekeeper to have charge of such household arrangements as do not pertain to the hospital portion of the establishment.

With the completion of a good wagon road, the question of furnishing a proper amount of supplies will be solved. It has sometimes been impossible to properly provide for the needs of the patients and guests on account of the inability to secure means of transportation. At times, however, the open market produces a number of acceptable articles of food. The potatoes grown in Benguet Province are very good; at times string beans, cucumbers, tomatoes, squash, comotes, and fruits, such as bananas, mangoes, limes, and pineapples, can be purchased.

During the rainy months, August and September, very few venders bring their goods to sell, so that chickens, eggs, and fresh vegetables are hard to procure, and fresh meat can very seldom be purchased.

The climatic effects on most of the patients who have come to Baguio seems to be very beneficial. When the sanitarium can become well stocked with chickens and is provided with cows, so that milk and eggs are available for the sick, a more rapid improvement in many cases may be expected.



AGNO RIVER NEAR AMBUKLAO, BENGUET.

Following is the report of the diseases treated at the sanitarium during the year:

Diagnosis.	Number.	Cured.	Im- proved.	Not im- proved.	Died.
Abscess, acute, of the thigh	1	1			
Colitis	1	1			
Cerebral hemorrhage	1		1		
Dysentery:					
Amoebic	9	4	4	1	
Chronic amoebic	4	2	2		
Catarrhal	4	2	2		
Acute	2	2			
Erysipelas	1	1			
Eczema	1	1			
Enteritis	1	1			
Chronic	1	1			
Fracture, compound arm	1	1			
Fracture and crushing injury, leg	1				1
Intestinal indigestion, chronic	1	1			
Malarial fever	1	1			
Neuralgia:					
Facial	1		1		
Intercostal	1	1			
Neurasthenia	9	1	8		
With facial neuralgia	1		1		
With constipation	1		1		
Pemphigus	1		1		
Proctitis, acute	1	1			
Pulmonary tuberculosis	1		1		
Rectal abscess	1		1		
Sprue	1			1	
Syphilis, with chancre and gonorrhea	1		1		
Syphilis	1		1		
Undetermined	2	2			
Septic lymphangitis	1	1			
Turpentine poisoning	1	1			
Total	54	26	25	2	1

Receipts from September 1, 1902, to August 31, 1903.

Month.	Mexican currency.	United States currency.
1902.		
September	\$103. 63	
October	63. 56	
November	1, 293. 24	
December	251. 75	
1903.		
January	521. 45	\$72. 50
February	265. 07	5. 00
March	317. 61	
April	113. 11	
May	576. 81	519. 43
June	3, 012. 23	435. 25
July	123. 95	366. 91
August	268. 66	52. 00
Total	6, 911. 07	1, 451. 09

Disbursements from September 1, 1902, to August 31, 1903.

Month.	Salaries and wages.	Contingent expenses.	Beautifying grounds.
1902.			
September.....	\$1,285.50	\$631.23	.....
October.....	792.58	397.60	.....
November.....	17.60	999.44	.....
December.....	1,935.78	1,459.14	.....
1903.			
January.....	1,935.78	1,459.14	.....
February.....	1,125.62	800.75	.....
March.....	1,001.00	1,752.18	.....
April.....	999.04	1,823.72	.....
May.....	1,455.40	4,051.94	.....
June.....	1,884.28	3,850.23	.....
July.....	155.43	432.86	\$409.75
August.....	11.50	498.68	.....
Total.....	12,599.51	18,156.91	409.75

All disbursements made in Mexican currency.

Very respectfully submitted.

L. H. FALES,
Acting Attending Physician and Surgeon.

In the absence of—

Dr. J. B. THOMAS,
Attending Physician and Surgeon.

The SECRETARY OF THE INTERIOR,
Manila, P. I.

APPENDIX E.

REPORT OF THE CHIEF OF THE FORESTRY BUREAU FOR THE PERIOD FROM SEPTEMBER 1, 1902, TO AUGUST 31, 1903.

MANILA, P. I., *September 14, 1903.*

SIR: I have the honor to submit herewith the report of the work of the forestry bureau for the period beginning September 1, 1902, to August 31, 1903.

The work of the bureau has progressed satisfactorily and steadily during the past year. The lack of suitable material in these islands for the personnel has made the work of securing competent technical men a very slow one. Less difficulty is experienced in securing good men for administrative work. Each man, after passing a civil service examination, is trained in the Manila office for at least one month and then sent into the provinces to join one of the older employees, and works at a forest station under his supervision.

An illustration of the growth of the forest service may be found in the following figures:

The service was started on April 14, 1900, by the undersigned, assisted by 8 men. At the end of the first year's work the force had grown to 84 men and a revenue of \$199,373.11 Mexican was collected on forest products taken from public lands. At the close of the second year, June 30, 1902, the force had grown to 125 men, and the revenue to \$348,073.08 Mexican. At the close of the third year, June 30, 1903, the authorized force amounted to 224 men, and the revenue collected amounted to \$527,414.85 Mexican. The force will, I hope, continue to grow at least at this rate until every acre of public forest in these islands is properly protected and all products are gathered under the personal supervision of local forest officers.

Changes in the force occur only too frequently. The former assistant chief, Capt. A. E. McCabe, resigned October 10, 1902, to enter the practice of law in Manila. The manager of the timber-testing laboratory, Mr. S. T. Neely, having barely started his timber-testing investigations, resigned April 30, 1903, to take a more lucrative position on a railway construction in China. Mr. Griffith, chief of the division of forest management; after six months' service, resigned September 10, 1902, to return to the United States by way of Europe, thus securing a trip around the world, partly at the Government expense. The Philippine government, however, did not pay his expenses to Manila.

It is the opinion of the undersigned that high-grade employees and a more satisfactory civil service would result if the salaries paid and the privileges granted employees were more on a line with those granted in the civil service in the neighboring colonies belonging to Great Britain and Holland. As a rule, the latter employees serve four years and are then granted one year's leave of absence—about

one-fifth of the civil service employees being usually absent on leave. If this longer term of service were the rule and higher salaries paid to American employees, part of the salaries paid could be retained until the expiration of the full period of satisfactory service.

Many applications were received by the undersigned from colonial foresters, botanists, etc., desiring to enter our service, but each application contained a number of questions which showed on their face that the answers would not be satisfactory, especially when they inquired as to the leaves of absence, retirement for disability and length of service, salaries, traveling expenses, etc. All applicants were notified that no provision had been made authorizing the employment of foreigners.

On November 19, 1902, the Philippine government passed act 527 providing for the return of forest revenues to the provinces, as follows:

The net amount of the collections under the forestry laws made in the provinces and in the city of Manila shall be, after July 1, 1902, returned pro rata to the provinces to which they respectively relate, after the entire expenses of conducting the forestry bureau and the service under its control shall have been deducted from the gross receipts. Such return shall be made as soon as the accounts of collections and disbursements shall have been settled and adjusted by the auditor. Such returns of forestry collections to the provinces shall be made upon certification of the amount due by the auditor, by settlement warrant, and for this purpose an appropriation of the sums so required is hereby made. One-half of all sums so returned to each province shall be covered into the provincial treasury, and shall be available for all lawful provincial expenses. The remaining one-half shall be divided among the several municipalities from which came the forest products on which the original collections were made, pro rata to the amounts originally collected on products from each municipality.

Act 530, passed November 30, 1902, provides penalties for unlawfully cutting and destroying timber on military reservations. The penalty imposed consists of a fine not exceeding \$500, or imprisonment not exceeding twelve months, or both.

Act 490, passed October 27, 1902, provides that the botanist for the bureau of agriculture shall also perform the duties of botanist in the forestry bureau. This provision is changed, the appropriation bill passed in July of this year transferring the botanist to the bureau of government laboratories.

On April 8, 1903, act 734 authorized the employment of six school-teachers as collaborators of the forestry bureau during their school vacation. These teachers were needed as collectors of forest botany. From a number of applications six were selected at a salary of \$75 per month and field expenses. These men were sent into the field with equipment and instructions, but with the exception of two the work performed was not satisfactory.

A collector of forest botany was selected in the United States by a competitive examination, which resulted in the appointment of Mr. Parker T. Barnes, who arrived in Manila December 28, 1902. He went into the field almost immediately and at brief intervals has been there ever since, doing very satisfactory work, and a class of work that is of immediate importance. Provision will be made during the coming year to give the collector a force of competent men to work under his direction in different provinces. There is a pressing need for a good working herbarium, as much of the work of the division of forest management, as well as that of the timber-testing laboratory and workshop, depends upon the correct classification of our more important tree species.

The manager of the workshop, Mr. T. J. Piffard, arrived in Manila November 30, 1902, and was followed in June by his assistant, another cabinetmaker, John Richter.

Act 807 of July 27, 1903, provides as follows:

That the chief of the forestry bureau is authorized, for the purpose of promoting the proper treatment of woods in cabinetmaking and other allied arts, and the making of fine furniture as a trade in these islands, to carry on in a limited way the finishing of furniture and manufactured articles of wood and to make a reasonable charge therefor, depositing the receipts in the insular treasury as miscellaneous receipts and accounting to the auditor therefor. The official receiving the money thus earned shall be designated by the auditor and properly bonded.

Mr. Gifford Pinchot, Chief of the United States Bureau of Forestry, arrived in Manila about the last of October, 1902, with instructions from the United States Department of Agriculture to investigate the forest resources of these islands. The Philippine government also requested him to submit a report concerning the forest conditions and the forest service. A gunboat was placed at his disposal and, with the undersigned, an inspection of the forests and the forest service was made, which lasted for more than six weeks, and included in our itinerary a large number of interesting forest tracts, from the island of Bongao in the south to the northeast corner of Luzon.

During this journey all spare time on board ship was devoted to arranging data for a report for a new forest law and regulations, and was also used in drafting a series of letters for immediate presentation to the Philippine government, covering the following subjects:

Organization, Philippine forest school, Philippine forest exhibit, forest policy, conduct of business, inspecting steamer.

Copies of these letters will be found as an exhibit to this report.

Mr. Pinchot's visit was of inestimable value to the service. He made a rapid but very thorough inspection of our important forest areas, examined the methods of exploitation, inspected forest stations in the provinces, and also thoroughly examined the methods of the Manila office.

The proposed forest act which was worked out during this trip is now before the Philippine Commission for consideration, and is a complete and comprehensive forest law. Section 4 of this law explains its purpose, as follows:

The public forests and forest reserves of the Philippine Islands shall be held and administered for the protection of the public interests, the utility and safety of the forests, and the perpetuation thereof in productive condition by wise use; and it is the purpose of this act to provide for the same.

There is a provision in this law for granting licenses for a longer period than the term granted at present, which is one year. It is proposed to extend this time to a five or ten year period. This privilege will act as an inducement to logging and milling companies to operate on a large scale. Provision is also made for reduction of government charges on forest products in provinces distant from Manila where large stands of timber are found, and also in such provinces where foresters shall select all timber for felling.

The regulations necessary to enforce this proposed forest act are about completed and will be published shortly after the forest law is enacted.

Mr. Pinchot strongly recommended that a steamer be assigned to the forestry bureau for inspection duty (see letter in exhibit). A steamer was promised, and on May 1, 1903, the coast-guard cutter *Marinduque* was turned over to this bureau. Two trips were made on

this steamer which were of great value to the service, and more work was accomplished in the three weeks thus spent than could have been accomplished by the ordinary means of transportation within as many months. The *Marinduque* was then assigned to other duty.

Late in July the quartermaster launch *Philadelphia* was assigned to the bureau. This launch arrived in Manila September 7, and will be available for duty within a few weeks.

The bill for the reorganization of the personnel (as per letter in exhibit) is ready for consideration by the Philippine Commission, and will be presented after the proposed forest law is enacted. This bill provides for controlling, executive, and protective staffs. The framework for the future force of the bureau is thus provided, so that, as the service grows, the only changes necessary will be in the authorized number of employees of each class.

Personnel.

Force authorized July, 1902.	Salary.	Force authorized at present.	Salary.
Chief of Bureau	\$3,500.00	1 Chief of Bureau .....	.....
1 assistant chief	3,000.00	1 assistant chief	\$3,000.00
1 manager timber-testing laboratory ..	2,400.00	1 manager timber-testing laboratory ..	2,400.00
6 foresters	2,400.00	6 foresters	2,400.00
4 inspectors	1,800.00	4 inspectors	1,800.00
1 chief clerk	1,800.00	2 clerks	1,800.00
2 clerks	1,400.00	1 clerk	1,600.00
7 clerks	1,200.00	5 clerks	1,400.00
6 assistant inspectors	1,200.00	1 civil engineer	1,400.00
4 clerks	900.00	3 assistant inspectors	1,400.00
6 assistant inspectors	900.00	5 clerks	1,200.00
2 clerks	600.00	3 assistant inspectors	1,200.00
10 assistant foresters	600.00	1 skilled workman	1,200.00
25 rangers	420.00	4 clerks	900.00
40 rangers	300.00	6 assistant inspectors	900.00
6 clerks	300.00	4 assistant inspectors	720.00
2 carpenters	240.00	4 clerks	600.00
2 messengers	150.00	13 rangers	600.00
1 woodworker	p. d. .75	40 rangers	420.00
		75 rangers	300.00
		2 draftsmen	360.00
		6 clerks	300.00
		8 skilled workmen	480.00
		6 skilled workmen	360.00
		13 skilled workmen	240.00
		6 laborers	150.00
		3 messengers	150.00

Launch crew, 12.

The following losses to the force occurred during the past twelve months.

Transfers from bureau	5
Resignations	26
Deaths	2
Removals	20

DIVISION OF INSPECTION.

This division has charge of the administrative work of the bureau.

On September 1, 1902, there were employed in this division 5 assistant inspectors, 10 assistant foresters, and 52 rangers, which force has been steadily increased until the present date. The present authorized force for this work consists of 4 inspectors, 20 assistant inspectors, and 128 rangers. The Philippine civil-service board has not been able to promptly fill requests for the certification of eligibles for this work. There are more than 30 vacancies in the list of recently authorized

rangers which are to be filled as soon as possible, as there is much important work waiting for each one. Some difficulty is experienced in finding Filipinos who are willing to serve in any province where ordered. All prefer to work in Manila, and when the time comes for them to leave for their provincial stations, find various excuses to defer departure. There was some excuse for this during the insurrection and while the provinces were disturbed, but at the present time there is no reason why rangers should fear service in the provinces.

On September 1, 1902, there were 42 forest stations established throughout the islands. This number has been increased to 55. During the year 5 stations were abandoned, 2 transferred, and 18 new stations established.

The Philippine Islands are divided into forest districts, usually under an inspector or assistant inspector, and each district includes a number of forest stations. An inspector has charge of the work of his district and spends much of his time in traveling, inspecting his stations. Each station is a subdistrict in itself, and the rangers in charge of the stations are authorized to inspect the towns within their districts and report at the end of each month concerning the same.

Forest districts and stations are as follows:

District.	Embracing provinces of—	Forest stations.	Official in charge.
Cagayan.....	Neuva Viscaya	Ilagan	Assistant inspector.
	Isabela	Aparri	
	Cagayan	Alcala	
		Claveria	
Ilocos	Subprovince of Bontoc	Laoag	Do.
	Ilocos Norte	Vigan	
	Ilocos Sur	Bangued	
	Abra		
Dagupan	Subprovince of Lepanto	Dagupan	First-class ranger.
	Pangasinan	Salasa	
		Tayug	
		San Fernando	
	Union	Baguio	
	Benguet		
	Subprovince of Amburayan		
	Northeast portion of Zambales		
Central Luzon.....	Tarlac	Tarlac	Assistant inspector.
	Pampanga	Arayat	
		Bacolor	
		San Isidro	
	Neuva Ecija	Calumpit	
	Bulacan (except Polo, Maycauyan, Obando, and Marilao)	Norzagaray	
Manila	Rizal	Manila	Inspector.
		Malabon	
	Laguna	Pasig	
		Pagsangan	
	Cavite	Paete	
	Reservation, pueblos of Bulacan:	Cavite	
	Polo		
	Obando		
	Maycauyan		
	Marilao		
Zambales.....	Zambales (except the northeastern part)	Santa Cruz	Forester.
	Bataan (except such parts as are reserved for military and naval purposes)	Subig	
		Orani	
Mindoro.....	Batangas	Batangas	Ranger.
	Mindoro	Calapan	
	Romblon	Romblon	
Tayabas.....	Tayabas and its dependencies	Antimonan	Forester.
		Guinayangan	
		Lucena	
Camarines.....	Ambos Camarines	Nueva Caceres	Forester, assistant inspector.
	Albay	Legaspi	
	Sorsogon	Sorsogon	
	Masbate	Masbate	

District.	Embracing provinces of—	Forest stations.	Official in charge.
East Visayas.....	Leyte.....	Tacloban..... Ormoc..... Catbalogan.....	Assistant inspector.
Central Visayas.....	Surigao..... Cebu..... Negros Oriental.....	Surigao..... Cebu..... Dumaguete.....	First-class ranger.
West Visayas.....	Bohol..... Iloilo.....	Iloilo..... Concepcion.....	Inspector.
	Antique..... Capiz..... Negros Occidental.....	Lagatic..... Bacolod..... Cadiz Nuevo.....	
Paragua.....	Districts of Misamis and Dapitan.....		
Mindanao-Jolo.....	Paragua..... Districts of Davao..... Matti..... Cottabato..... Zamboanga..... Basilan..... Jolo.....	Puerto Princesa..... Davao..... Matti..... Cottabato..... Zamboanga..... Isabela..... Jolo.....	Assistant inspector. First-class ranger.

One or more rangers are located at each forest station. At the Iloilo station are 1 inspector, 1 assistant inspector, and 7 rangers.

New stations will be established at the following points as soon as rangers are available: Daet, Lagonoy, and Pasacao, Camarines; Unisan, Tayabas; Paluan, Mindoro; Pinamalayan, Mindoro; Tagbilaran, Bohol.

As soon as inspectors and assistant inspectors can be trained for the work it is thought advisable to place one in charge of each of the following districts: Dagupan, Zambales, Mindoro, Tayabas, Central Visayas, and Mindanao-Jolo.

All forest products are noted on a manifest which must accompany each shipment. This manifest notes the class, amount, and value of the product, the name of the licensee, the number and location of license, the place where the products were gathered, destination of same, and whether or not the government charges have been paid on same. In order to collect the government charges on forest products a local forest officer issues an order of payment, which is taken by the licensee to the provincial or municipal treasurer for payment. Receipt for said payment is then shown the forest officer and note of payment made on the manifest and the products allowed to be removed. No employee of the forestry bureau is allowed to receive money in payment for forest products, fines, or any other charges.

A second inspection, classification, and measurement is made at the destination of the cargo, and any changes in the amount manifested are noted on this second inspection.

During the year about 19,000 copies of manifests were forwarded to the Manila office. At the forest stations manifests are made out in triplicate. The original is given to the licensee, the duplicate retained in the forest station, and the triplicate forwarded to the Manila office.

The term "provincial manifests" is applied to all those copies of manifests that are forwarded by the forest stations in the provinces to the head office.

In the early part of the fiscal year 1902-3 a circular was issued to all stations prescribing the serial numbering of all manifests as soon as made out by the forest officers in the provinces. By this means the Manila office can see at a glance which manifests, if any, are missing, and as copies of manifests are not forwarded to the Manila office until

paid for, one can, by referring to the statement of utilizations, learn which manifests should have been sent.

When the copies of manifests are received in this office they are given a Manila number, in order that the posters may be able to quickly check their entries and that there may be no break in the numeration in the files, thus avoiding the constant reference to a book of the manifests received, which would of necessity have to be kept if a new series of numbers were not given them. The manifest is then entered in the ledger, and the posters check the name appearing in the manifest with the name of the licensee, and the town of the manifest with the town of the licensee. He also learns whether there has been cut under the license more than the amount granted, and makes a corresponding note on the manifest.

The manifest is then turned over to the cubicators, who check the volume and appraised value. If correct, it is marked O. K.; if incorrect, a notation is made to that effect. The fault clerk then examines the manifest. In case the cubications are incorrect, or the timber is undersized or cut without license, and no fine imposed or imposed incorrectly, or any other inaccuracy occurs therein, he writes a letter to the ranger calling his attention to the mistake, and points out the remedy.

The manifest is then placed on file provisionally, a record being kept thereof in a book provided for that purpose. In case of delay in settlement the manifest is taken out of the file and the necessary action taken. In case the manifest is found correct it is placed on file.

Each operation above mentioned is initialed by the person performing same.

The term "city manifests" is applied to manifests of timber brought to Manila. The reports of the second inspection of the cargo corresponding to these manifests are now all checked over.

The office work in all the provincial stations has been made uniform by the introduction of the following books:

I. Register of Manifests (with index).

This book shows the number of each manifest, the name of the licensee or owner of the product, its origin, kind, and quantity; Government valuations and fines (if there are any), destination of product, date of manifest, number and date of issue of the order of payment, date order of payment was received by the payor and date paid, the treasury into which paid, date on which duplicate manifest was forwarded to the head office, and remarks.

This book shows at a glance the business done at any station; also which orders have been paid and which are pending.

II. Register of Licenses (with index).

This book gives the name of every licensee operating within the jurisdiction of a forest station, his residence, number and date of license, place in which authorized to cut, his representative and his representative's address, etc. In the case of timber licensees a page is devoted to each, on which is kept a record of the amount of timber cut, as a check on the licensee, who is permitted to cut a definite amount of timber. By means of this book any data required relative to licensees may be easily and quickly referred to.

III. Register of Letters Sent and Received (with index).

In this book a record is kept of the number of each letter sent and received, date sent or received, name of writer or addressee, and the

subject-matter of the letter. By means of this book a letter can be quickly found. Under the Spanish system which was in vogue up to the time of its introduction in nearly all stations, letters were placed in various packages according to their subject-matter. In case a ranger had not complied with the instructions of a certain letter, there was not always proof that he had received it, as many letters were missing and a poor record kept of letters sent and received.

A new form—Report of Orders of Payment—has been prepared. At the close of each month this report will be sent by the forest station to the provincial treasurer of the province in which the ranger is located. One side of this form will be devoted to orders of payment issued during the month; the other side to orders of payment issued during the previous months and still unpaid, so that in the future when provincial treasurers send their deputies on trips of collection through the provinces, they will know where to look for forest orders. It is hoped that by thus calling the attention of the provincial treasurers to the number of outstanding orders of payment a decrease in the number of same will result.

DIVISION OF FOREST MANAGEMENT.

The work of this division during the past year has been mainly the examination of forest tracts in certain provinces, with a view to securing data for the intelligent granting of timber licenses for the fiscal year, and the formulation of rules for the marking of timber to be cut by the licensees in those provinces where the special work is carried on. This has necessitated quite a broad study of the general conditions, the various species present, their relative abundance, and their power of reproduction under the virgin conditions, and also where openings have been made by former lumbering; the latter giving a general idea as to what reproduction may be expected in future after lumbering has taken place. A study was also made of the general lumbering methods in vogue in the region, the accessibility of the timber, labor conditions, and the prices paid per cubic foot for timber delivered at the shipping point, and amount paid for hewn and round timber when bought in the forest. This work has been carried on entirely by the six foresters in the employ of the bureau, and two assistant inspectors specially detailed as assistants in the work.

After a general examination of the tract and a study of the reproductive features, the territory is divided as nearly as possible by natural boundaries into districts, to which various licensees are to be assigned. These tracts vary in size according to the stand of timber upon the same, the class of timber, and general accessibility. In general no two concessioners will be allowed to operate on the same tract, and in assigning applicants to any district they are given their choice of location as far as possible. In allowing only one licensee to operate in one district, inspection is made much easier, and parties can then be held responsible for all operations in any such district assigned to them. It will also insure to the licensee the entire benefit to any improvements made by him, such as logging trails, etc.

In considering applications for timber licenses for the present year in places where foresters are stationed, applications are made on the regular form and forwarded by the ranger to the forester in charge of

the district, who passes upon the same and recommends or disapproves the application. In case of approval he designates the region in which the applicant should be granted a license to cut timber, the amount which can safely be cut in a region during the year, and any data of interest which will assist in carrying on the work in an intelligent manner. Before an application is approved, the financial ability of the applicant is investigated, the implements he possesses for carrying on the work are ascertained, and also his general ability to live up to the forestry regulations. All applications, whether approved or not, are then sent to the main office in Manila, where licenses are granted. However, in those districts in which foresters are stationed, firewood licenses are granted by them, and a monthly report of same is submitted to the main office. They are also empowered to grant gratuitous licenses for a house, one banca, agricultural implements, etc., to needy residents, not to exceed 300 feet in those districts where bamboo is used to a large extent in the construction of houses. In districts where bamboo is little used, due to its scarcity, the maximum limit is 500 feet. All gratuitous licenses for public works are granted only from the main office.

As soon as all the timber licenses are issued the foresters commence marking timber in the different regions where licenses have been granted by the main office. This marking is usually done by making a blaze near the root of the tree and stamping the same with a hatchet having the letters "F B" on its head. A blaze is also made and a mark placed on the bole above the point where the tree is to be cut.

Under the general forest conditions found in the islands one forester can mark from 5,000 to 6,000 cubic feet per day of all classes of timber, but with one or two assistants a much greater amount can be marked. When marking timber the forester is usually accompanied by the concessioner for whom the timber is being marked, or else by his representative who is to have charge of the lumbering in the forest. The presence of the licensee or his representative is necessary in order that the approximate location of the marked timber may be known to the lumbermen, and at the same time he will be instructed by the forester regarding the method which it is proposed to adopt. Any uncertainties can be dispelled by the forester, and the lumberman can start in with his work and carry on the same in an intelligent manner and in conformity with the existing regulations.

When marking timber in any given place especial attention is given to the trees of the superior and first groups, and in marking they are given the preference over other species as far as possible by leaving a sufficient number of seed trees to insure ample reproduction, and inferior trees are marked for removal so as to aid the reproduction of the better species. Care, however, is exercised not to mark too much inferior timber for removal if the same will involve a loss to the licensee when it is placed upon the market. The main object of the marking is and should be the bettering of the present stand, and the removal, as far as possible, of all inferior species, without imposing too great a hardship upon the licensee. As the market opens up for new woods, as it is certain to do in the near future, there will be a sale for many kinds of timber which at the present time do not come into the market, and when that time comes an increasing amount of species undesirable in a silvicultural way can be removed.

The following rules will be insisted upon in all operations in the forest where timber has been marked for felling:

(1) All marked trees must be cut unless a satisfactory reason can be given for not doing so.

(2) No timber not marked shall be cut unless a satisfactory reason can be given for so doing.

(3) All timber lodged in felling must be utilized if sound.

(4) All sound timber in felled trees must be utilized down to a diameter of 10 inches, and no sound logs shall be left in the forest.

(5) No timber of the superior or first groups shall be used for levers, skids, pries, scaffolding, or like purposes.

(6) The cutting point on the bole of any tree shall not be more than 6 inches higher than the stump is wide at the point of cutting, except in cases where there is a pronounced root buttress, in which case the tree shall be cut at a point midway between the ground and the upper termination of the buttress.

(7) Every man operating in the forest must carry with him, and when called upon by a forest official must present, a written authorization from the licensee by whom he is employed. All timber cut by parties not holding said written authorization shall be considered as cut fraudulently, and the government valuation and fines will be imposed on the same.

HACIENDA AND MANUMILING FORESTS, SUBIG, ZAMBALES.

"Hacienda" and "manumiling" forests being the only wooded areas of importance occupying the slopes extending up from the western shores of Subig Bay, and having many features in common, as slope, exposure, and soil conditions, may, with few exceptions, be considered in common under one description.

But from 40 to 50 per cent of this slope is of forest land, the greater portion being arid or covered by a growth of bunch grass.

Manumiling forest occupies a central position and can safely support three licensees, while hacienda, which is of small size, occupies the northern portion and can safely support two licensees, both for a period of at least four years. This forest area has an average slope of about 30°, the southern end being limited by the China Sea, while the north is bounded by the Cauag River. A number of small, insignificant rivers drain its surface, but are not of suitable size to aid lumbering. The surface cover is a semiprocumbent tecal, which in places forms a dense tangle over the forest floor.

Soil conditions.—The soil consists of a loose, sandy loam of light brown or gray color, varying considerably in depth, according to physical conditions, being in places thin and rocky. The general character is of the latter, but as tree growth is generally good in such cases, one is led to believe that a continuous rocky subsoil is absent. The surface is generally loose and dry, the extreme porosity of the upper layers exercising a protective influence over the lower strata, hence drying out does not proceed as rapidly as where there is a more compact underlayer. In the deep, wooded ravines the soil is rather moist, and on steep slopes where well covered it is not excessively dry.

The texture of the soil is rather coarse and of a flocculated character. Being loose and occupying a steep slope, it is liable to wash badly, and in open lands many rocks are exposed in the numerous gullies and deep ravines. The soil, being of light color, is not so susceptible to the drying influences of the sun as is a dark-colored soil.

Rock.—The entire slope is of a rocky nature, the latter varying in size from small surface rocks to large exposed bed rock of volcanic origin, apparently "trap." Large seams of small-sized rocks extend up and down the slopes at frequent intervals, the color of the rocks varying from dark brown to grayish black, and where exposed to the weather for a long time their surface has become much corroded, and in one place a long, recently formed deep fissure, apparently of volcanic origin, was seen. Earthquakes are commonly experienced here.

Forest areas.—Between the forest proper and the sea there is a narrow belt of semi-open land of a general swampy character, which is covered with grass and "nipa" palms and affords pasturage for carabao and deer. A few scattering species, such as agoho and banaba, are found here. The agoho occurs frequently in small groups and attains a diameter of 20 inches, but such large specimens are rarely found. In

many places a good reproduction of this species occurs in all stages, and the seeds having no special means of transportation and not being eaten by animals, the reproduction is generally in groups, in the midst of which is the parent tree.

Where this great zone joins the rather steep slope, the forest proper begins. From the lower edge of the forest, extending for several yards upward, is a steep, rocky terrace, formerly well wooded, but having been severely lumbered, is now more or less open.

Here occur such species as caña fistula, apitong, and mayapis, and in places too rocky to support large trees one finds camuning and small-sized bolongeta. This terrace is characterized by numerous surface rocks and trees of rather shorter boles than is typical in these species, while their occurrence is not so frequent as when the soil is free of rocks.

Immediately above this terrace, and extending in a more gradual slope, whose average width is a half mile, one finds a valuable forest, composed of trees of large size. This bench is comparatively free from rocks and has a deep soil, apparently transported from the upper treeless zone during the rainy season. Here occur apitong, dila-dila, cato maching, yacal, and palo maria. Following the slope upward one comes gradually to a less dense growth, where apitong and mayapis are the only important trees, and finally to the open grassy slope with short scrubby trees. Agoho is found on the upper slope, occupying the ravines, but is of small size. The open grass land is frequently burned by the natives and the few trees injured or killed.

Dividing these two forests is a narrow strip of grass land having a soil similar to that of the forest. This strip is sparsely studded with trees of all ages, but the smaller ones are killed or much injured by fires. Trees growing well in the open, generally in small groups, are mayapis, agoho, and apitong.

Manner of occurrence of important species.—The requirements and manner of occurrence of apitong and mayapis are almost identical, both thriving on the well-drained slopes either as individuals or tending to form small groups. In mature species their trunks frequently closely resemble each other both as to character of surface and as to shape. Their crowns, however, show a difference. Clear lengths of 70 feet are to be found.

Apitong is somewhat less cylindrical than panao, but in the mature stages they closely resemble each other. Unsound specimens of apitong or mayapis, due to fungi, are rarely seen, perhaps due largely to the scarcity of vines in the forest. A defect known as "cup shape" is not uncommon in larger apitong, but is rarely seen in mayapis.

Yacal may have been formerly cut here, but at present all large trees of this species are hollow and only serve as seed trees. Agoho occurs commonly in open places, but, as with yacal, the large sizes are unsound. Palo maria (bitoc) is found largely on the higher slopes and in size up to 24 inches diameter breast-high. Small trees of this species are frequently cut. Malapalic is an important species occurring here in large sizes and large squared sticks are cut out. This species is probably next in importance, commercially, to that of apitong and mayapis. Sasalit is common but the natives rarely cut it. It is said to last well as posts in house construction and is so used by the natives. Tagatoy is used locally for house construction but is not cut for commercial purposes. Malacatmon is cut for commercial use and is of common occurrence in these forests. Ebony and camuning are found here in numbers; the ebony, however, is of small size.

This forest, occupying a comparatively narrow strip adjacent to Subig Bay, with sufficient slope, offers easy means of transporting timber. Narrow, rocky trails lead to various cuttings, which are of the characteristic poor condition, but with little expense could be greatly improved. Assisted by the slope, logs of large size are easily removed. Logs of apitong and mayapis, whose volume is 50 cubic feet, require from six to eight carabao, while similar sizes in the forest of Dinalupijan require more than twenty. The sides of a deep ravine, through which flows the Hacienda River, are clothed with fine apitong and mayapis, but the rocky bed of this stream being the only means of egress, renders removal very difficult. Only square sticks are removed, the hewing being done in the forest. These pieces average about 24 feet in length and are seldom less than 15 inches square. They are skidded to the shipping point, and when a sufficient number are collected are bound into rafts and shipped to Manila. When possible, the lighter species, such as lauan, are placed underneath and serve to buoy the heavier ones. Where all species are too heavy to float, bamboo rafts are constructed. Very few bancas are constructed, as suitable species are rarely found. The smaller size of the squared timber are frequently shipped from Subig in large cascoes.

The origin of this forest is from seed alone, and, being irregular, one finds trees of all stages. Apitong and mayapis, however, in mature stages form an upper story. One finds a good reproduction of various stages and in good, healthy condition.

The general density is not so great as one finds in forests of less rocky soil, thus allowing a better light for development of younger species. The general character of the timber is straight and of a good merchantable size. Clear lengths of apitong of 70 feet are found.

From the extremely loose character of the soil, and hence its liability to wash, it is important that too severe cutting should not be allowed. Examples of washing are observed in the open lands, where numerous deep gullies have been found, exposing many rocks.

Conditions after cutting.—The accessibility to the sea probably favors the more complete utilization of timber, as few logs are left after cutting, and a large part of each tree is taken, leaving a comparatively good condition of forest. The cutting of high stumps is not a noticeable feature.

The absence of large, climbing creepers is noticeable and allows a better condition after cutting. When present they are agents of destruction, breaking the crowns from smaller trees to which they are attached or tending to lodge others. Bamboo being of rare occurrence, its use in construction of scaffolds for cutting and hewing is replaced by smaller tree species. Many small-sized palo maria have been cut and allowed to remain in the forest. A number of fungi are at present attacking such species as yacal and the larger palo maria. The species attacked, however, show great age.

The collection of resin from apitong and mayapis is a common practice among the natives here. Large cup-like notches are cut in the trunks of the larger trees, into which the resin flows and is regularly collected for local use. These incisions frequently extend to the center of the tree in order to make a large receptacle. Should such cuts be made only in large, mature trees, such as would be removed within a short time, the injury would be but slight, but a number of smaller, immature trees are thus cut. There are several reasons why this method of resin collecting should be prohibited:

I. The cut extending well across the trunk so weakens it that it is liable to be blown down during high winds, leaving a long, split stump.

II. When made in smaller trees it greatly retards growth.

III. This cut, exposing the wood surface and forming a cup where water may collect, forms a favorable place of entrance for fungi, and in many instances trees have been almost totally destroyed.

At this season the resin flows freely and is collected every few days into cans and used locally or sold in Manila.

Fires.—The character of the forest being rather open allows a good reproduction of various species, and such being the case fires accompanying extensive cuttings are more serious than those of the denser forests where but little seeding has been effected previous to cutting. The firing of open grass land has been practiced for a long time in order to give pasturage to carabao and aid in hunting. Fires of local extent are common and no attempt is made to stop them.

Rules for lumbering.—From investigation of lands already severely lumbered and of previously cultivated areas which are now abandoned and coming into forest, one is led to believe that density does not play so important a part in reproduction as that of lands farther inland. It is, however, quite important that a proper density for seeding and sufficient for prevention of soil washing should be maintained, as the soil is of a loose character. The first consideration, therefore, in the formation of cutting rules, would be to give proper density for seeding. Not having at present any means for determining the rate of accretion, but presuming them to have passed the grand period of growth, the soil being rather thin and unfavorable to rapid growth, it will be well to set a conservative diameter limit.

Species cut at present are largely mayapis and apitong. For these species a diameter limit of 20 inches breast-high is advised. Should there occur on 1 acre an insufficient number for proper seeding whose diameter breast-high is less than 20 inches, then at least two of each species, well placed, should be left for seed trees.

WILLIAM M. MAULE, *Forester.*

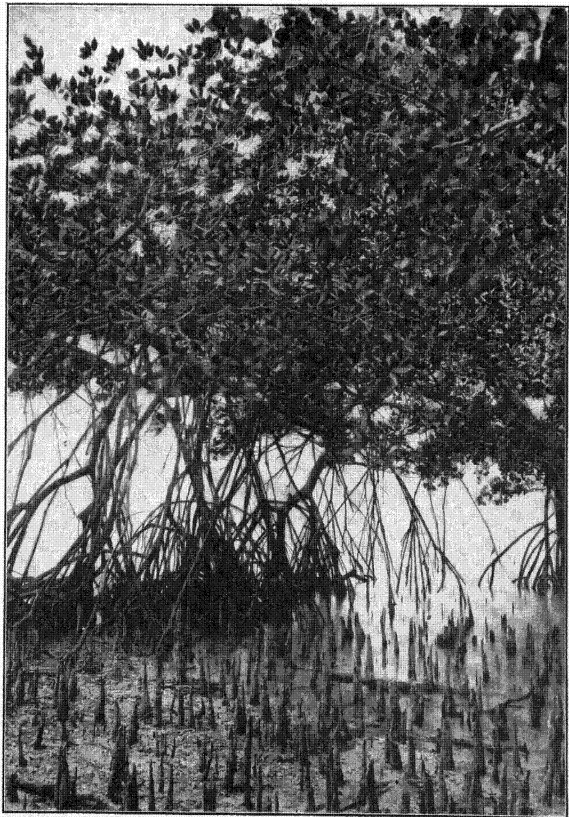
Work of this character had been carried on in the following provinces, in charge of the different foresters:

Northern Bataan and southern Zambales, with headquarters at Subig.

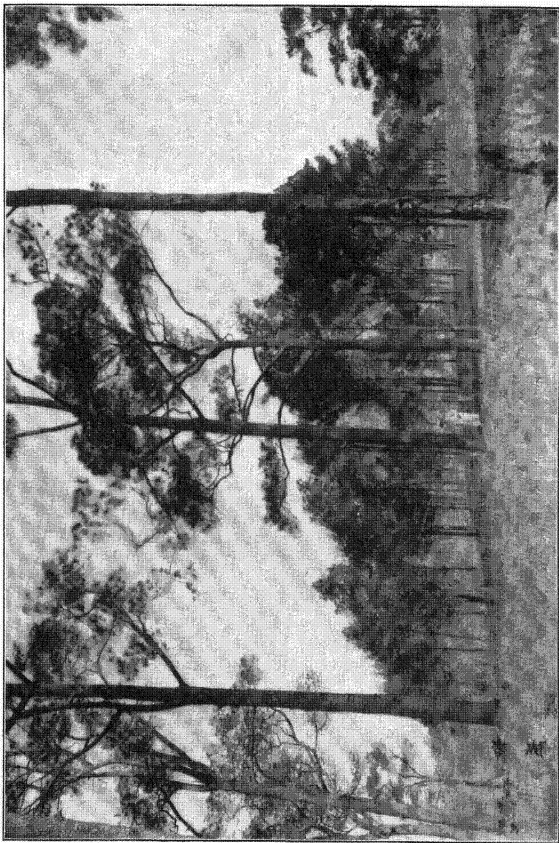
That part of Tayabas bordering on the Pacific Ocean, with headquarters at Atimonan.

The southern coast of Tayabas, with headquarters at Lucena.

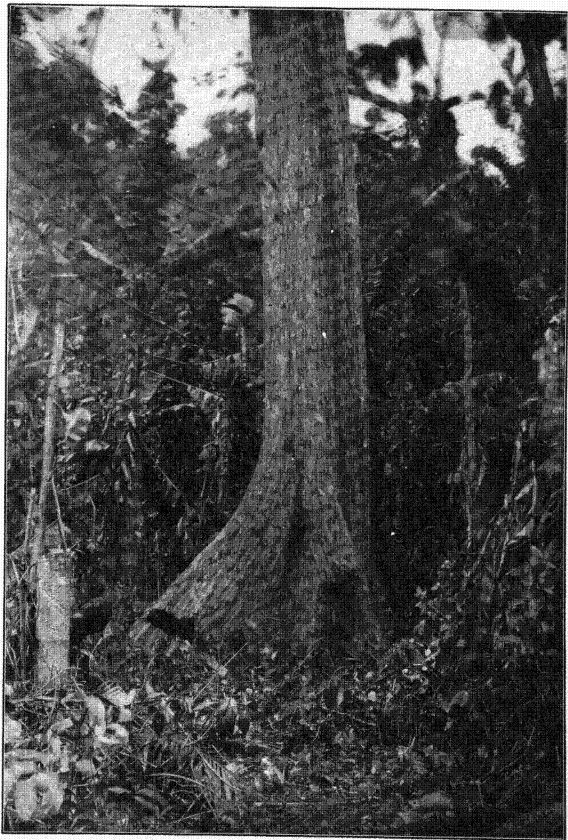
The territory in the region of the Gulf of Ragay and Camarines Norte, with headquarters at Nueva Caceres.



BACAUAN (*BRUGUIERA CARYOPHYLLÆOIDES*, BLUME) GROWING IN SALT MARSH.



TOPULAO, TYPICAL STAND.



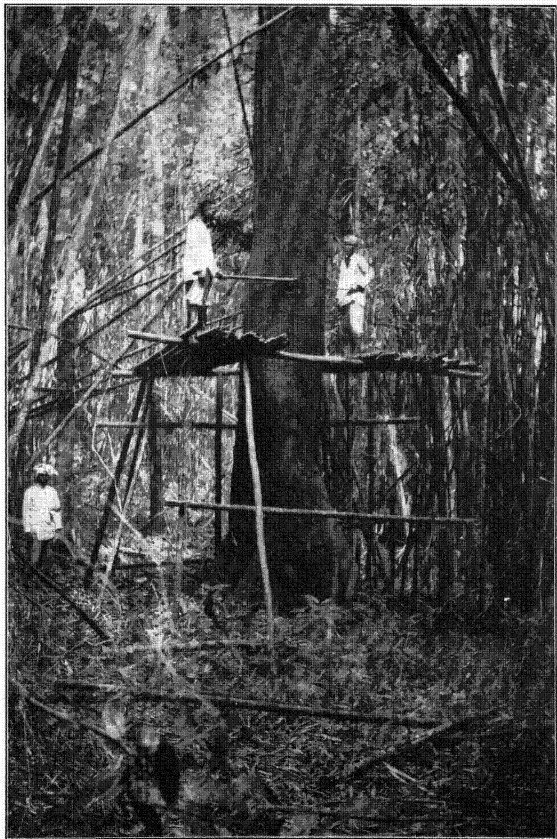
NARRA (*PTEROCARPUS INDICA*), SHOWING BOLE AND ROOT BUTTRESSES.



LAUAN (*ANISOPTERA THURIFERA*) IN VIRGIN FOREST, NEGROS.



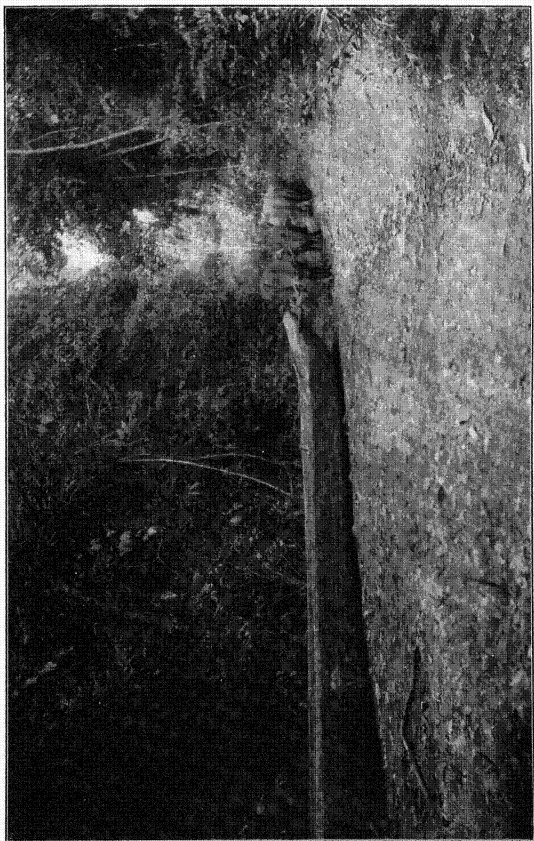
TAPULAO (*PINUS MERKUSII*), ZAMBALES.



FELLING A LARGE TREE.



APITONG (*DIPTEROCARPUS PILOSUS*), BOXED FOR RESIN.



FOURTEEN CARABAOS SKIDDING LOG 300 FEET LONG.



The province of Masbate, with headquarters at Masbate.

Mindoro and Batangas, with headquarters at Calapan.

The latter district has been given up temporarily after an examination of the forests on the east coast, as the forester in charge was detailed on other work. However, as soon as a forester is available the work should again be started here.

In addition to the work outlined above, each field party has been called upon to devote more or less time to the collection of material for the St. Louis Exposition and for the bureau. The material for the exposition has consisted mainly of logs 30 feet long for the forestry building at St. Louis, of which some 150 were secured; and also 12-foot logs, which are to be finished as samples. A botanical collection was made to accompany these logs for their proper identification, this material being turned over to the botanist of the bureau, who, after identifying it as far as possible, placed the same in the herbarium. Numerous samples of by-products of the forest, including gums, resins, vines, bejucos, tan bark, dyewoods, bamboos, etc., were collected for exposition purposes.

One party, consisting of a forester and the collector, was solely engaged in the work of securing logs and botanical material from January 1 to May 1 in the vicinity of Pagbilao, Tayabas. The party was then transferred to Masbate, where the collector continued the work until in July, when he returned to Manila. From Manila he was sent to Lamao, Bataan, where a site for a forest school, nurseries, etc., are being prepared.

During the latter part of January and the first of February an inspection was made of the operations going on in the vicinity of Baguio, Benguet. A large amount of timber was marked here for the various licensees and for the construction of government buildings, mainly by the inspector in charge of the district, and an attempt was made to control the cutting of timber near the new town site of Baguio.

An examination was also made of a large hacienda in the province of Nueva Ecija, the owner of which had made application to the bureau for registration.

The forest region around the Gimogon River in Negros Occidental was investigated during May at the request of the Electric Company of Iloilo, who are at present operating a wire-cable system in the forest near the barrio of Sanghai on the above river. The report submitted covered the stand of timber found near this barrio, the lumbering possibilities, and general methods which should be pursued in that region. This territory contains some of the finest timber so far seen in the islands, and the topography of the country is such that it can be easily lumbered with a cable system such as is being employed at the present time.

The field work commenced in July, 1902, at Baler, Tayabas, was completed in November of the same year, and the final report submitted in December. This region, while not containing as much merchantable timber as some other parts of the islands, proved to be very interesting in a botanical way, and some new species and one new genus were discovered in the small botanical collection of tree species which was made there. As opportunity presents itself, this region should be carefully worked over in a botanical way, as comparatively nothing is known of this part of Luzon Island.

During the month of June the entire work of issuing licenses was

placed under this division, and licenses for the present fiscal year have been so issued. The statistical work of the bureau has also been placed under the division, the license and statistical work being carried on by two American and four Filipino clerks.

REPORT UPON THE FOREST CONDITIONS NEAR THE GIMOGON RIVER, NEGROS OCCIDENTAL.

The forest proper begins about 6 miles up the river from the coast, and about one-half mile from the barrio of Sanghai.

The region for several miles to the south, east, and west in the timber belt is very flat, with a very gradual rise as one goes south. The country is scarcely broken by small streams. In fact, the country is an ideal one for the construction of lumber roads and the hauling out of timber.

The Gimogon River passes through this region, generally in a very crooked course, and the high tide affects the level of the water in the river for a distance of 1.3 miles above Sanghai. The river, however, is navigable for bancas for a considerable distance above this by pulling the boat over small rapids which occur at occasional intervals. Between these rapids there are stretches of deep water, and with the expenditure of a few hundred pesos, cleaning out the rocks on the rapids, perhaps building small sluices where necessary, and placing booms in some places to direct the logs in the right channel, the river can be made driveable during the dry season for several miles above Sanghai. During the rainy season the level of the river will be higher and logs can undoubtedly be driven without any improvements being made. To the east of the river the flat nature of the country will permit drawing logs by wagon or cable system directly to the river, where they can be driven down the stream to the proposed sawmill site, on a flat just south of Sanghai. In many places the large timber on both sides of the river comes within 50 feet of the bank and can be put into the water at a low cost.

Owing to the large diameter of a greater part of the timber, it will be very difficult, if not impossible, to handle the largest logs by means of carabao, as is the present custom in the islands, but by means of a cable system such as is employed in many regions of the United States, the largest timbers found here can be handled with ease. Another advantage of a cable system will be the greater rapidity with which logs can be hauled to the river, ability to take out the largest timbers, which are also the most profitable, and the necessity for fewer laborers and a very limited number of animals. As to the cost of operation of such a cable system in the islands, I am unable to state at the present time, since no operations of this sort have ever been carried on here.

The general character of the forest in this region is very similar, practically all of the merchantable timber belonging to the family Dipterocarpace, and composed principally of almon (*Palosapis*), lauan, apitong (panao of northern Bataan), and balbagan, a tree undoubtedly closely related to lauan. At least it has many of the same characteristics, and the general properties of the wood seem to be the same. It also goes under the name of red lauan.

Scattering specimens of mangachapuy, catmon, bago-santol, baganito (a *Diospyros*), guijo, taba-taba, and occasionally a specimen of other species of small diameter, but in general little merchantable timber will be found outside of the first four kinds mentioned.

The trees are all of fine form, with long straight cylindrical boles; clear lengths of 70 to 100 feet and at times 125 feet are found, with diameters up to 96 inches. The trees generally appear to be quite sound and free from punk knots, though occasionally the larger trees show some signs of disease.

The forest is virgin, and only on the edges of same near settlements has any timber been taken out, and then merely to supply bancas, generally for local use. Considerable damage has been done in some places, however, by destroying large timber in the making of "caingins." The silvicultural condition of the forest is in a bad state at the present time, due to the presence of a large number of overmature dominant trees, with large spreading crowns, which take up much light space, and also draw a large amount of nourishment from the soil. The present forest is composed of these old overmature trees and seedlings and saplings, there being a decided absence of trees in the pole-wood stage, from 6 to 12 inches in diameter. The absence of these poles in the greater part of the forest I believe to be due to the light conditions, as brought about by the larger trees. The seedling reproduction is in almost all cases excellent for lauan, almon, and apitong, where large trees of the latter are abundant; also fair for balbagan. They, however, do not seem to be able to get above a certain size before they are crowded out by the large trees.

A judicious opening up of the forest by the removal of some of the larger trees would benefit the young growth greatly.

More large decaying trees were seen on the ground than is common in the other forests visited, and this I believe to be due to the natural decay of the overmature trees. The large trees which have reached maturity and are adding wood only very slowly at the present time should be removed as soon as possible, in order not only to secure the timber before its decay, but also to allow the young growth to develop and form a new forest. It does not appear to me that the lumbering of this region would greatly damage the young growth, even though the trees have large, heavy crowns. The reproduction being of small diameter would naturally bend easily under the weight of the crown and thus many be saved, and the abundant seedling growth would soon fill in any gaps left. Great care, however, will have to be exercised after lumbering operations commence to prevent forest fires, which would undoubtedly run with great vigor among the dry tree tops and brush and destroy almost the entire seedling crop, the main hope of the future. Especial care will be necessary if a "donkey engine" is used in the forest. A spark arrester will be an almost absolute necessity in order to prevent the spread of fire from sparks. Although the forest is practically free from fires at present, there can be no doubt that the danger will be greatly increased upon the admittance of a greater amount of light upon the ground cover and the collection of a large amount of refuse. I believe the lopping of the smaller limbs of the crown should be insisted upon, and the same piled in some place where there will be the least damage done to the remaining growth.

The question of the disposal of the timber and firewood in the tops will be a serious problem, and some contract should be entered into with lumbering concerns before the granting of any license to them to cut timber, to utilize all tops down to a diameter of 3 inches, said companies to have the free use of same, provided they are removed during the logging operations and before they move to another part of the forest. It will not be advisable to allow their removal several months after the timber is cut, on account of the additional damage which will result to the smaller growth after it has begun to recover from the previous lumbering. Many of the large limbs will be of sufficient size to furnish box material and the remainder could be made into rajas (large firewood) and shipped to Manila during the rainy season, when the price of rajas is always high.

All timber to be cut in this region should be marked by a forester from the bureau, keeping in mind, when marking, the removal of all mature trees where the reproduction is good but marking no timber below 20 inches in diameter, unless the improvement of the stand demands it. All trees below this diameter to be left as seed trees, except as noted above, and should there not be a sufficient number below this size an occasional tree above this diameter should be left. The seeds being fairly light will germinate some distance from the parent tree.

The soil here is apparently very rich, deep, and admirably suited in most places for agricultural purposes, especially the raising of sugar cane; and should in the future a demand arise for this land for such purposes it should not be kept in forest, as it will be more valuable for the former purpose. This demand, however, will probably not arise for many years to come, there being large areas of abandoned land in this region which should be taken up first.

When operations begin here, should the company cut as much as intended per day, 20,000 B. M., a ranger should be stationed here permanently to scale the timber before it leaves the forest for the mill. This work, in connection with any other duties which may arise in the vicinity, would fully occupy the time of one man.

The average stand of timber in the region described will also apply to a much larger region to the east, south, and west; the conditions, so far as the stand of timber is concerned, being very similar.

The following results are deduced from 31 quarter-acre counts made in the area, and represent the stand in English cubic feet, after deducting 30 per cent for defects in the standing timber, both seen and unseen, though trees appearing of no value were left out entirely in the original estimate. The above percentage of defects has been found to be nearly the percentage found in this class of timber, especially lauan, when cut in the southern provinces of Luzon, and I believe will hold good here. To reduce the cubic feet to board feet, I believe that a factor of 8 could be safely applied here, owing to the large average diameter of the trees. Therefore, multiplying the cubic feet by 8 will give approximately the stand per acre in board feet.

Table showing average number of trees per acre, average diameter, and stand per acre in English cubic feet for all trees 20 inches and over in diameter.

Species.	Average number trees per acre.	Average diameter.	Cubic feet per acre.
Lauan	10.56	32.14	1,733.09
Almon	6.44	40.20	2,130.77
Apitong	5.28	30.24	601.81
Balbagan	3.08	40.41	574.09
Mangachapuy .....	.48	36.25	119.40
Guijo .....	.12	45.00	37.27
Other species .....	.88	25.55	88.57
Total	26.82	.....	5,285.00

This estimate I believe to be very conservative, and will be found to be below rather than above the average on the tract.

This table shows an average diameter, the first six species, of 37.37 inches, taking all trees 20 inches and above in diameter, an average which is above that found on any tract previously investigated. The average number of trees per acre, 20 inches and above in diameter, is 26.82, of which lauan forms 39.37 per cent; almon, 24.01 per cent; apitong, 19.69 per cent, and balbagan, 11.48 per cent.

However, almon ranks first in number of cubic feet per acre, due to the greater average diameter of the trees of this species. Almon and balbagan in this region are used for the same purposes as lauan, and the former at least would sell equally well with lauan.

The lauan, apitong, almon, and balbagan are among the standard construction timbers in use in the islands, and there is a strong and constant demand for them. During the last fiscal year 17 per cent of all timber cut in the islands was lauan, which is more than twice as much as was cut of any other one species; 8 per cent was apitong, which ranks second in the amount cut of any one species, and almon and balbagan being similar to lauan will find as ready a market as the latter. The species of the third group, to which the above four belong, furnish 48 per cent of all the timber cut in the islands during the past fiscal year, and during the coming year will probably constitute a still greater per cent (50.4).

Lauan, almon, and balbagan can be sawed easier than many species, as they are not extremely hard, and this, coupled with the fact that they will float and can be driven in the river, adds considerable to their value in the present proposition, and will materially lessen the cost of placing this timber upon the market.

The market price in Manila for manufactured lumber of this class during the past year has been from \$38 to \$50 gold per 1,000-board feet. The other species were not placed upon the market under the names known here, but they should sell for about the same price as lauan.

The haul of timber in this region will begin on the river bank and extend back for several miles in all directions, so that the first operations will involve but a very short haul before the logs can be placed in a driveable stream.

The cost of laying timber down at the shipping point is very hard to determine, as no timber, except an occasional banca, is cut for the market here at present. Carabao are quite scarce here, being mainly owned and employed on the various haciendas in this region. The supply of laborers is limited and uncertain, as most of the natives are dependents of the haciendas and hence can not be relied upon to work at all steadily for any outside parties. Any lumbering operations carried on here to any extent would necessitate the importation of laborers from outside points.

The sawed timber from the mill should be transported to market by steamers or launches owned by the lumbering concern. No boats run regularly to any points near here, and freight rates would be high. The large amount of timber to be handled would undoubtedly soon pay for any outlay made for transportation. Transportation companies would charge at least 40 cents Mexican per cubic foot as freight charge to Manila.

For a lumber company possessing the capital necessary to secure a wire cable system, build a small sawmill, and place their own sawed timber upon the market, I believe this to be one of the most desirable locations to be found in the Philippine Islands; for here is found a fine forest of large trees, a river navigable for several miles in a launch and driveable for logs several miles further, a very flat country in which to lumber, and an amount of timber of the class used to a great extent for

construction purposes in the islands, which will last for many years. The main forest belt extends for many miles south and could be easily tapped by a tramway or narrow-gauge railway, though such a tramway will not be necessary for some time, as the supply near the river is sufficient to last for several years. A branch railroad could be constructed from Sanghai east to Escalante, a distance of 12 to 14 miles, or to some point on the Danao River, which is navigable for the largest vessels for at least $3\frac{1}{2}$ miles. This country through which such a road would pass is generally flat, and the road could be constructed quite cheaply. Such a road would give the company an opportunity to load the largest interisland vessels in a well-protected place, where timber could be loaded at any season of the year and sent to market.

I believe every encouragement should be extended to the company which proposes to commence operations here, as it will serve as an object lesson in modern lumbering in the islands and will tend to relieve the present scarcity of timber in the Philippine markets.

After completing the investigation on the Gimogon River I proceeded by trail to the vicinity of Bao-bao hill, where the company had in mind the placing of a large mill. The contemplated outlet for this timber is by a railroad from a small barrio on the Danao River several miles up from the coast. My time was quite limited here and I did not get far into the forest. The species found are much the same as those in the Gimogon River region, but the country appears to be somewhat rougher.

From Bao-bao I proceeded to the barrio of Tomblon, still farther east, and went into the forests south, southeast, and southwest from the barrio. Traveling is very difficult here owing to the fact that no trails extend into the forest more than $1\frac{1}{2}$ miles from the barrio, and the natives did not appear to be acquainted with the region beyond this. They seldom go far into the forest, fearing the Negritos and ladrones which are said to infest the region to a certain extent. There are about 15 houses at this barrio and probably 25 to 30 able-bodied workmen. The sole occupation of the natives here appears to be the gathering of bejuco for the towns along the coast, practically no timber being cut except where caingins (clearings by fire) are made. The forest here begins a short distance south of the barrio and extends in quite a solid body for a long distance south, interrupted here and there by a caingin, either of the natives or Negritos. The forest is much inferior to that of the Gimogon region, though the species are much the same, lauan predominating. The average diameter of the trees is much lower, the number of trees per acre considerably less, and the opportunity to get them out is more unfavorable than in the former place, due to the lack of water transportation and to the rougher character of the country. Superior first and second group woods I was informed were to be found south and southeast from this barrio, but diligent inquiry from the natives showed that they had no knowledge of them. Later, however, I learned that these tree species could be found several miles south of the barrio in a region which I did not visit. In the vicinity of this barrio there is not sufficient timber to warrant a lumber company operating to any extent. About two miles south of the barrio almost the entire forest seemed to be composed of small trees, resembling a second-growth forest, with only an occasional large tree. I could assign no reason for the absence of large timber, as the young growth appeared thrifty and healthy and there were no signs of any lumbering or of any fires which had destroyed the larger trees. The soil here in places was thin, and may be underlaid with a hardpan which would tend to eliminate the larger trees.

R. C. BRYANT,
Chief Division of Forest Management.

Licenses, as a rule, are granted for a period of one year, beginning July 1 and ending June 30 of the following year. No charge is made for licenses. Payment is made as the forest product is gathered.

Licenses are of four kinds: Timber, firewood, gratuitous, and minor products. The form of application for licenses will be found in the appendix.

A careful record is kept of each application and action taken on same. A card index is kept of all licensees and of all persons violating forestry regulations. All applications for licenses must go through the local forest station for remarks by the ranger, inspector, or forester. These remarks include all available information concerning the status of the applicant, his equipment for logging, etc. The applica-

tions are then sent to the Manila office for action. Each license, with a copy of the forestry regulations, is sent to the licensee through the local forest station.

Foresters are in charge of five provinces—Zambales, Bataan, Tayabas, Camarines, and Masbate—where the largest logging operations are conducted. The foresters have made a thorough reconnaissance of the forests of the province under their charge, have investigated the logging facilities and status of each applicant for a license, and have divided the province into districts, giving to each licensee exclusive territory. These foresters are now selecting timber for felling for the coming year, and all timber felled in their provinces will be such as has been selected for felling. The foresters make occasional inspections to see that licensees comply with the rules for cutting and all other forestry regulations.

The foresters and inspectors have been granted authority to issue in a limited way, licenses to cut firewood, gratuitous licenses for from 300 to 500 feet, and timber licenses to 500 cubic feet. Owing to the lack of mail facilities, transportation, etc., it has been very difficult for people in distant provinces to communicate, even with local forest stations, so that when they needed a small amount of timber they found there was so much delay in securing blank forms of applications for licenses, that by the time the license itself reach their hands many months had elapsed. To do away with this delay the above authority was granted foresters and inspectors, so that when they visit the towns in their district they are able to grant at once licenses for small amounts. This has a tendency to do away with much illegal cutting.

In granting licenses the first consideration is given applicants who have held licenses in former years and who reside in the district applied for.

The following licenses were granted during the fiscal year ending June 30, 1903:

Licenses granted during fiscal year ending June 30, 1903.

Province.	Timber.	Firewood.	Gums and resins.	Dyewoods, etc.	Charcoal.	Gratuitous.					Total licenses.	
						Needy resi- dents.	Amount granted.	Public works.	Amount granted.	Fire- wood.		Total.
Albay.....	9	6						2	2,823		2	17
Abra.....	28	18	1		4	3	854	7	20,437		10	61
Antique.....	13	9				5	283	2	6,000		7	29
Bataan.....	30	41	1		1	3	1,453	5	25,122		8	81
Bulacan.....	30	10			4			2	3,000		2	46
Batangas.....	13	13		1		1	900	1	1,000		2	29
Benguet.....	9							2	3,000		2	11
Bohol.....	3	3						2	16,000		2	8
Cagayan.....	30	8				15	6,029	2	6,000		17	55
Camarines.....	30	34	1	1	1	4	455	4	16,200		8	75
Cottabato.....	5	4	12	2								23
Cavite.....	8	18						1	1,000		1	27
Cebu.....	11	6						1	1,000		1	18
Capiz.....	26	21				34	22,540	1	1,000		35	82
Davao.....	6	2	10	2								20
Ilocos Norte.....	30	4				20	5,583	6	27,800		26	60
Ilocos Sur.....	30	12			1	2	1,100	5	32,972		7	50
Iloilo.....	30	43		14	8	47	8,043	2	2,624	1	50	145
Isabela.....	30	1				2	500	4	11,900		6	37
Jolo.....	2											2
Laguna.....	28	12			1	10	4,019	1	1,000		11	52
Leyte.....	30	9						4	26,607		4	43
Lepanto-Bontoc.....						1	10,000	2	1,750		3	3
Masbate.....	30	26	10	4		6	1,800	2	11,000	1	9	29
Mindoro.....	29	39	3	13	2	3	1,379	4	15,033		7	93
Misamis.....	8	3	1					3	12,000		3	15
Nueva Ecija.....	30	15				1	526	2	11,000	1	4	49
Negros Occidental.....	46	41	9	1		7	3,240	3	16,000	1	11	108
Negros Oriental.....	28	11				1	21	3	5,620		4	43
Nueva Viscaya.....								2	6,000		2	2
Pampanga.....	30	25						3	36,000		3	58
Pangasinan.....	31	40	1		1	61	12,200	3	12,000		64	137
Paragua.....	20	7	6	5		1	10,000	2	6,000		3	41
Rizal.....	23	32	4			68	14,550	1	1,000		69	128
Romblon.....	20	9	4			112	32,762	2	4,000		114	147
Sorsogon.....	27	17						3	27,419		3	47
Surigao.....	20	6	2			9	5,531	12	15,744		21	49
Samar.....	25	8				4	1,300	5	55,000	1	10	43
Tayabas.....	32	37	15	8		16	6,699	2	3,000		18	110
Tarlac.....	30	45	2		1	14	3,727	6	6,280		20	98
Union.....	21	1						2	1,800		2	24
Zambales.....	30	59	7	1	19	8	5,832	3	14,000		11	127
Zarabotnga.....	27	18	9	1		2	1,151	3	51,918		5	60
Grand total.....	938	713	98	53	43	460	162,477	122	518,049	5	587	2,432

Individual timber licenses are granted for 10,000 cubic feet. Company licenses are granted for 100,000 cubic feet.

Thirteen company licenses were granted as follows:

Company licenses 1902-3 and amount of timber cut.

Company.	Location granted.	Amount granted.	Amount cut.
Danao Lumber Co.....	Danao River, Negros Occidental.....	<i>Cubic feet.</i> 100,000	<i>Cubic feet.</i> 847
Boston-Iloilo Co.....	{ Cabancalan, Negros Occidental..... Dancalan, Negros Occidental..... Caoayan, Negros Occidental..... Guijulgan, Negros Occidental.....	100,000	None.
Far East Timber Co.....	Paluan, Mindoro.....	100,000	None.
Mindoro Lumber Co.....	Baler, Tayabas.....	100,000	7,615
Mindoro Commercial Co.....	Bongabong, Mindoro.....	100,000	14,600
Philippine Lumber and Development Co.	Dalupaon, Camarines.....	100,000	106,869
Compañía Madera de Luzon.....	Ragay, Camarines.....	50,000	23,242
Philippine Lumber and Commercial Co..	Sta. Maria, Zamboanga.....	100,000	31,264
Masinloc Improvement and Development Co.	Bungaan, Zamboanga.....	100,000	None.
Chicote & Sanchez.....	Davao.....	100,000	1,915
Mertigui & Co.....	Villaba, Leyte.....	100,000	None.
Inchausti & Co.....	Iloilo.....	100,000	None.
Schuck Bros. & Co.....	Tawi Tawi.....	100,000	None.

Licenses granted from July 1, 1903, to August 31, 1903.

Province.	Timber.	Firewood.	Gratuitous.	Minor products.
Rizal.....	12	14	8	.....
Albay.....	6	3	1	.....
Abra.....	16	.....	1	.....
Antique.....	.....	.....	1	.....
Bataan.....	29	15	1	.....
Batangas.....	14	16	1	1
Bulacan.....	16	5	1	6
Benguet.....	3	.....	1	.....
Bohol.....	2	.....	1	.....
Cavite.....	2	9	1	.....
Cebu.....	8	.....	1	.....
Capiz.....	9	.....	1	1
Cagayan.....	20	.....	1	.....
Camarines.....	13	7	2	6
Cotabato.....	.....	.....	.....	3
Davao.....	6	.....	.....	11
Ilocos Norte.....	20	.....	4	.....
Ilocos Sur.....	7	.....	1	.....
Iloilo.....	15	20	1	20
Isabela.....	1	.....	1	.....
Laguna.....	20	.....	4	.....
Leyte.....	15	2	1	.....
Lepanto-Bontoc.....	2	.....	1	.....
Mindoro.....	20	17	1	14
Masbate.....	36	.....	1	3
Misamis.....	4	.....	.....	.....
Nueva Ecija.....	20	2	1	.....
Negros Occidental.....	22	21	1	7
Negros Oriental.....	10	10	1	.....
Nueva Viscaya.....	.....	.....	1	.....
Pampanga.....	18	8	1	1
Pangasinan.....	20	16	2	3
Paragua.....	12	.....	4	7
Romblon.....	17	3	1	3
Sorsogon.....	14	11	2	.....
Samar.....	14	10	2	1
Surigao.....	12	.....	1	2
Tarlac.....	21	22	3	2
Tayabas.....	44	14	2	19
Union.....	17	.....	1	.....
Zambales.....	52	20	1	21
Zamboanga.....	20	12	5	12
Total.....	609	257	67	143

The military authorities were granted exceptional cutting privileges on account of military operations, and also to facilitate the construction of military posts. The following circular was issued concerning same:

Circular No. 27.]

FORESTRY BUREAU,
Manila, P. I., January 24, 1903.

The secretary of the interior, upon the request of the commanding general of the United States military forces of the Philippine Islands, has, in an indorsement dated the 23d instant, authorized this office to grant permission to cut gratuitously such timbers of all groups as may be necessary for such insular work as is being executed or carried on by army officers; the report of timber used to be submitted by the officer in charge of the work, after cutting, to the chief of the forestry bureau. The local rangers only are to be notified in advance by the official in charge of the work of such wood as is going to be cut. Contractors supplying such wood shall be regarded as agents of the official in charge of the work. The officer in charge of the work shall be held responsible that the contractor cuts only such timber as he delivers to him to be used in the work specified.

The demands for gratuitous licenses of towns suffering from the effect of fires and storms were promptly met and licenses granted. As a rule, an inspector or other forestry employee visited the town, investigated the conditions, and in each case was granted authority to issue the necessary licenses. A report of one such investigation is included in the appendix.

All applications for licenses and all correspondence referring to same are filed in the division of forest management, separate from the general records of the bureau. Twenty-eight hundred and fifty communications, principally applications for licenses, were received during the year. Of this number 2,430 applicants were granted licenses, an increase of 85 per cent over the number granted during the previous year.

TIMBER-TESTING LABORATORY AND WORKSHOP.

The work during the year marked progress toward definite knowledge of Philippine woods. Much difficulty is experienced in securing suitable wood specimens, due to the lack of communication and transportation in the islands. Metal tags corrode in the water, so that all marking has to be done by cutting numbers and letters into the wood.

During the year 128 complete tests were made on 80 different species of wood. Only such woods are tested as are determined botanically.

The procedure followed in testing is to cut from a log two beams, each 4 by 5 inches in section and about 6 feet long. One of the beams is placed in a kiln to be dried to about 10 per cent moisture, and the other beam is tested green.

In testing, the beam is carefully planed and the ends squared. The beam is then measured with a vernier caliper at both ends and in the middle. The length of the beam is determined to one-tenth of an inch and the weight is determined to one-tenth of a pound. The beam is then placed in the 200,000-pound Tinius Olsen testing machine on two supports exactly 60 inches apart, and is loaded at the center until failure results. To prevent a weakening of the fiber by abrasion the beam is protected from the supports and loading knife-edge by wooden blocks. After being broken in the "cross-bending" test the uninjured parts of the beam are sawed into blocks for "compression end-wise," "compression sidewise," "shear," and "tension" tests. The compression blocks are 6 inches high with a cross section of 4 by 5 inches; the tension pieces have a breaking section of about 1 by 2 inches, and the shear piece, after numerous other designs had been

tried and abandoned, was designed to shear a section about 4 square inches in total shearing area from the block.

A determination of the percentage moisture of each block tested was made by cutting thin wafers out of the block and weighing them before and after being dried in an oil kiln. Besides obtaining general determinations of the specific gravity of a beam, separate determinations of the smaller blocks were made.

Rate of loading and computations.—The 200,000-pound testing machine used is designed to test beams up to 60.0 inches span. Power is transmitted by belt from the main shaft to a large pulley-wheel of the testing machine. By means of a friction wheel, a friction clutch, and a shifting gear four different speeds may be obtained. The time consumed for a single test varies from two to ten minutes, according to the nature of the test.

Cross bending.—In this test the deflectograph is employed, for which great credit is due to Mr. Neely, who designed it. In its essentials the deflectograph is a vertical pantograph, which multiplies the deflection of the beam five times. Besides eliminating the amount of work necessary to a cross-bending test, it enables the engineer to find accurately the deflection corresponding to any given load, a profile paper-carrying cylinder being designed to move through one of its divisions for each 1,000 pounds of load while the deflection is traced upon it. Power is applied by the slow friction wheel and the weighing arm is kept balanced until failure occurs.

This test gives the stress at elastic limit denoted by “Se,” stress at rupture denoted by “Sr,” and modulus of elasticity denoted by “Ee.”

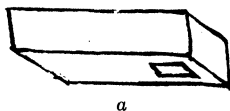
$Se = \frac{3 Pe x s}{2 b d^2}$ where “Pe” is the assumed elastic limit, being the load corresponding to that point on the deflection curve where the curvature is 50 per cent greater than at the start of the curve; “s” is the span in inches; “b” is the width of the beam in inches, and “d” is the depth of the beam in inches.

$Sr = \frac{3 Pr x s}{2 b d^2}$ where “Pr” is the load at rupture.

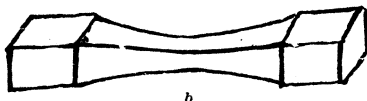
$Ee = \frac{Ee x s^3}{6 \Delta e x d}$ where Δe is the deflection in inches at the elastic limit as determined from the deflection curve.

In the “compression endwise,” “compression sidewise,” “tension,” and “shear” tests, the results are obtained by dividing the total load by the area of the part broken.

The tension piece was shaped as follows:



The shear piece had this for its design:



The general specific gravity of the beam is found as follows: Let “b” equal the mean width of the beam in inches; “d” equal the mean

depth in inches (determined from the measurements mentioned above) and "1" equal the length in inches. Let "*w*" equal the weight of the beams in pounds.

$$\text{Then Sp. G.} = \frac{w}{1 \times b \times d \times 0.036}$$

For the smaller blocks:

$$\text{Sp. G.} = \frac{w}{1 \times b \times d \times 16.37} \text{ where "w" is the weight in grams.}$$

Special notice.—Worthy of special notice among the woods tested because of their excellence are alupag-amor, bancoro, banitan, bitanhol, dagat-laya, lanete, talisay, and macapali. Alupag-amor showed the remarkable strength of 15,110 pounds per square inch in "compression endwise." The stress at elastic limit ("Se") equalled 17,620 pounds per square inch and strength at rupture ("Sr") equalled 19,700 pounds per square inch. On a par with this are the results obtained with macapali, a wood from Mindanao. This wood showed a specific gravity of 1.32 and a stress at elastic limit equal to the stress at rupture, "Se" equals "Sr" equals 14,500 pounds per square inch.

At this time no absolute comparison between United States and Philippine woods may be made because of the small number of tests made upon Philippine woods. As indicative of the general character of the woods, the following tests are compared with tests made in the United States on American woods:

Philippine timber, crushing endwise, strength per square inch.

[Average of 5 or more tests.]

Alupag-amor.....	15,110
Betis.....	11,270
Dungon.....	10,570
Molave.....	10,460
Dagat laya.....	10,410
Calamansanay.....	10,370
Dilang bitiqui.....	9,780
Bitanhol.....	9,670
Ipil.....	9,000
Tindalo.....	8,800
Bancoro.....	8,430
Supa.....	7,230
Tucan calao.....	7,170

American timber, crushing endwise, strength per square inch.

[From United States Bureau of Forestry tests.]

Pignut hickory.....	10,900
Mockernut hickory.....	10,100
Butternut hickory.....	9,600
Pecan hickory.....	9,100
Cuban pine.....	9,080
Longleaf pine.....	7,930
White oak.....	8,500
Texan oak.....	8,100
Water oak.....	7,800
White ash.....	7,200
Green ash.....	8,000

Workshop.—The most serious problem confronting the forester in the Philippine Islands to-day consists in working out some use for the vast variety of unknown woods that grow in these islands. There are undoubtedly between a thousand and fifteen hundred tree species growing in our public forests, of which about 50 varieties take up 80 per cent of the timber entering the market. A few varieties are popular because they are known to be good, but the average contractor will not cut the unknown varieties because he is uncertain of selling same in the market. This problem has been commented upon by the foresters of India, but no attempt has been made to solve the same. The undersigned has undertaken to solve this problem by establishing a workshop in which specimens of the unknown woods would be thoroughly seasoned and worked up into some shape so as to make them marketable if possible.

The first and most important step was to secure the right man to take charge of this important work. The man was found in Mr. T. J.

Piffard, a cabinetmaker in Rochester, N. Y., who had, in addition to his cabinetwork, familiarized himself with all modern woodworking machines and studied the chemistry of stains, and prepared himself for just such work as I had contemplated having done. He arrived in Manila November 30, 1902, and shortly after his arrival authority was received to erect a two-story building adjoining the timber-testing laboratory. This new building is 40 by 40 feet, and in it is installed the workshop. The sheds adjoining the workshop, where all seasoned timber is piled, covers a space of about 40 by 40 feet.

During the past year as wood specimens were received, they were cut up and piled away. At the present time there are more than one hundred varieties of wood in the yard, which will shortly be worked up into some shape.

The force in the workshop consists of about 50 men, including about 20 men temporarily employed in assisting the others in preparing material for the St. Louis Exposition. The workmen include fine Filipino wood carvers, finishers, and about 15 good carpenters. The other workmen are laborers and Chinese sawyers.

These workmen are being carefully trained in American methods of work, and all seem to appreciate their instruction, and are progressing very satisfactorily. Each carpenter is encouraged to gradually purchase for himself a complete set of tools, the bureau furnishing wood for handles and a model box for the set. In a short time, with the rate at which the men are accumulating their tools, each man will have a complete equipment, so that after two or three years instruction in the shop, a Filipino carpenter will feel competent to do independent work and will be encouraged to go into business for himself.

A complete set of modern woodworking machines have recently arrived from the United States and are now being set up.

Much difficulty is experienced in purchasing material needed by the cabinetmakers, such as fine varnish, rotten stone, stains, and many other articles which were never supplied in the market. Fine cabinet-making had never been carried on in the Philippines and such articles had never before been required.

The recently received authority from the Philippine Commission to dispose, by sale, of articles finished in the workshop will enable the Bureau to place the same, within a year, on a paying basis.

Microscopic sections.—Some uncertainty exists in correctly naming even a number of the more important Philippine woods on account of their great similarity. Even such woods as tindalo, ipil, and supa are confused. Apitong and panao, ebony, camagon, bolong-eta, and other species similar to the latter are difficult at times to distinguish apart. Sections of these woods under the microscope show great difference in structure.

The services of Mr. J. J. Eaton were secured to make these microscopic sections and have photographs of same made. After much preliminary investigation, in which Mr. Eaton found that the methods as used in the United States were not applicable to the Philippines owing to the great hardness of the leading Philippine woods, success has gradually been attained, so that now we have photographs of at least three sections of each of forty different varieties of Philippine woods, including many of the more important species. A bulletin will be issued during the coming year, giving photographs of sections of the more important woods, in addition to full data concerning the results of tests of the timber-testing laboratory, prices in the market and

other information which may be needed by those interested in handling these woods.

A complete set of sections and photographs will be kept in the laboratory so that when any woods are presented for determination, sections may be made of same at once and compared with the photographs on hand in the office. Sections and photographs of same will be taken of specimens from sapwood and buttress of the same tree from which the heartwood has been taken.

The original sections mentioned above have been made from a small sample of heartwood taken from a tree from which fruit and flower has been taken and determined by the botanist. In making the three sections one is made perpendicular to the fiber, one parallel to the medullary rays, and one tangential section.

A number of sections will be made from the same tree species found in different parts of the islands and growing under different conditions so as to ascertain if there is any marked difference in the wood structure.

Botany.—In the past year about 1,200 identifications have been made, of which 200 were made from imperfect material, leaf specimens only. Duplicates of other material which could not be identified in Manila have been sent to specialists in Europe for critical identifications. The herbarium for the bureau of agriculture is combined with that of the bureau of forestry. There are over 5,000 specimens in the herbarium, of which 4,281 were collected in the Philippines. Of these, 1,973 specimens were secured by employees of the forestry bureau from the time of the organization of the bureau in May, 1901, to the present time. The remaining 308 specimens were secured by employees of the bureau of agriculture and from various other sources since the organization of that bureau in April, 1902, and to this should be added 843 specimens from foreign countries, received during the past year.

The botanist of this bureau, Mr. Merrill, was sent by the forestry bureau, on August 30, 1902, to Java to make investigations there, the results of which are contained in a bulletin which is now in the press and which will shortly be issued. This bulletin will be entitled "A report on investigations in Java," and consists of "A report on the trip," "a report on the Botanical Garden at Buitenzorg," "A report on the methods employed in investigating the forest flora of Java," and "A scientific enumeration of the Philippine plants with notes and descriptions of new species."

At the present time data are being compiled for "A Dictionary of the Native Plant Names of the Philippines," a work that is greatly needed by the employees of the forestry bureau.

Of a total of 660 tree species enumerated in the tariff list 302 have been collected and identified during the past year. Wood specimens were also taken at the same time. The above identified list include nearly all of the more important Philippine woods.

One employee of the forestry bureau was detailed especially on investigation of the dyewoods of the Philippines. Visits were made to the provinces from which dyewoods are collected and a careful investigation of same made. More than 100 varieties were secured, specimens of which were sent to the bureau of government laboratories for investigation as to their value as dyewoods. Specimens of the same collection were also sent as part of the exhibit for the St. Louis Exposition. A bulletin on this investigation will be issued during the coming year.

A field party consisting of a forester, assistant inspector, collector, and about ten natives are at present on the Lamao River, in Bataan Province, preparing ground for a forest nursery, a future forest school, and also making a study of the tree species in the Lamao watershed, which covers about 12,000 acres, ranging from sea level to 4,500 feet above the sea. At least 300 tree species are found in this area and a careful study is now being inaugurated of the same. Five hundred to a thousand trees will be selected, labeled with large wooden labels and extensive notes made of each species. The location of each labeled tree will be noted on a map, so that there will be no difficulty in making future studies of each one.

A large variety of tree seed has been collected and started in Manila. The same will be transported at an early date to the field party for transplanting into beds when the same are prepared.

The first nursery site has been selected at an elevation of 500 feet above the sea. The second nursery will be at an elevation of about 1,800 feet. The forest school will probably be located at the first site mentioned.

A fairly good road has been constructed at the landing place at Lamao to the first site. There will probably be no engineering difficulties encountered in constructing the road from the 500-foot level to the 1,800-foot point.

Material has been gotten out for several houses, which will soon be erected. Nipa and bamboo houses will be erected for the laborers so that all employees may have their families with them.

There is a very heavy stand of good marketable timber on two-thirds of this tract, so that within a few years much of the expense of the forest school may be met by conservative lumbering carried on under the supervision of the school authorities.

Number and area of private woodlands registered in the Forestry Bureau.

Province.	Number of estates.	Area.		
		Hectares.	Areas.	Centares.
Tarlac	26	47,024	73	39
Mindoro	2	24,185		
Isabela	7	14,052	20	5
Pampanga	71	8,661	13	16
Rizal	1	4,651	20	12
Zamboanga	2	2,459		
Davao	2	1,150		
Camarines	1	923	60	72
Nueva Ecija	5	859	62	58
Romblon	2	649	92	50
Bulacan	2	644	96	73
Pangasinan	1	479	90	15
Bataan	2	364	76	37
Negros Occidental	1	293	62	80
Laguna	1	195	71	62
Cadiz	2	97	99	26
Manila	1	54	56	
Total	129	106,647	96	43

The largest estate is that belonging to Marcelino Santos, located in the provinces of Tarlac and Nueva Ecija. Area, 13,202 hectares, 44 areas.

Quantities of forest products taken from the public lands of the Philippines during the fiscal year July 1, 1902, to June 30, 1903.

DISTRIBUTION.

Province.	Timber (maderas).	Fire- wood (leñas).	Charcoal (carbon).	Dye wood sapan (nigue.)	Tanbark (casca lote).	Dammar, gum copal (almaci- ga).	Gutta- percha (gutta- percha).	India rub- ber (goma elas- tica).
	<i>Cubic feet.</i>	<i>Cubic meters.</i>	<i>Cubic meters.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>
Abra	65,208	1,630						
Albay	83,564	62						
Antique	14,423	1,600	5		11,855			
Bataan	416,739	32,881	110					
Batangas	18,132	3,863	4	530	350			
Benguet	15,088							
Bohol	15,893	468						
Bulacan	285,700	3,758	244					
Cagayan	140,688	1,320						
Camarines	382,815	7,856	12			18,216		
Capiz	44,609	7,279	1	39,710				
Cavite	11,153	5,882	18					
Cebu	27,047	917			2,000	17,779		
Cottabato	14,240	3,194			4,905		351,721	
Davao	12,214					1,140,543	14,385	
Ilocos Norte	50,870	337				137		
Ilocos Sur	43,329	4,788						
Iloilo	95,981	22,017	1,015	5,446,777		2,434		
Isabela	41,448							
Jolo		80			20,344	42,047	19,995	1,293
Laguna	109,259	1,404						
Lepanto	65							
Leyte	125,023	1,963			56,687			
Masbate	162,262	8,765			121,691			
Mindoro	130,982	2,462		44,055	89,643			
Misamis	39,436	2,680			1,207	7,872		
Negros Occidental	252,316	7,320			1,165	7,583		
Negros Oriental	44,449	758			411			
Nueva Ecija	114,854	12,540						
Pampanga	193,455	19,630	228		7,535			
Pangasinan	134,653	5,950	7					
Paragua	40,125	154			3,555	87,712		
Rizal	36,259	14,225	1			4,867		
Romblon	49,702	149			4,384			
Samar	16,119	265			44,080			
Sorsogon	76,467	1,699						
Surigao	26,340	397			49,364	41,750		
Tarlac	345,849	14,950	75			5,343		
Tayabas	592,598	14,187	1	31,321	118,795	2,567		
Union	51,562	763						
Zambales	319,180	10,148	2,075	6,380	1,238	4,587		
Zamboanga	100,642	259			361,754	12,535	223,472	
Total	4,740,738	218,100	3,795	5,568,773	900,963	1,358,172	609,573	1,293

Quantities of forest products taken from the public lands of the Philippines during the fiscal year July 1, 1902, to June 30, 1903—Continued.

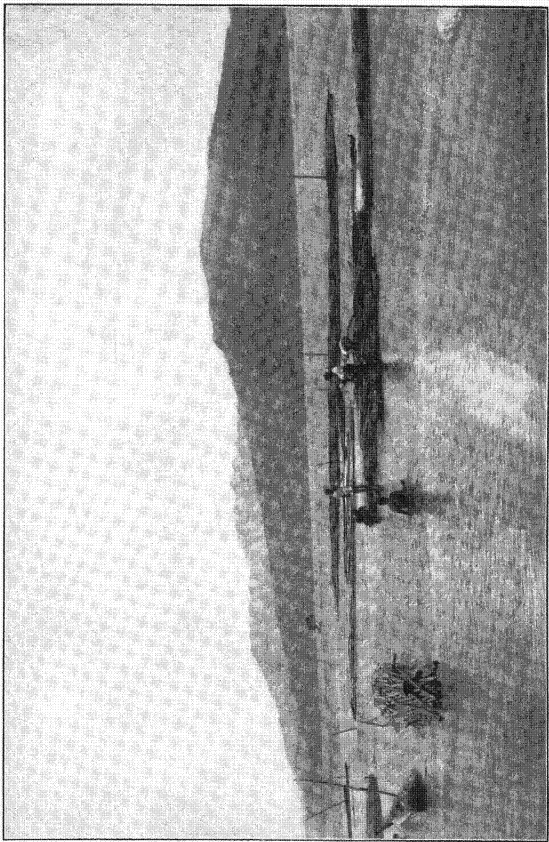
DISTRIBUTION—Continued.

Province.	Breas, resins (balsam and allied products).	Oils, panao, wood oil (lumbang).	Bees-wax (cera).	Rattan (dilliman bejuco).	Gratuitous.		Private estates.		
					Tim-ber.	Fire-wood.	Tim-ber.	Fire-wood.	Char-coal.
	<i>Pounds.</i>	<i>Liters.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Cubic feet.</i>	<i>Cubic meters.</i>	<i>Cubic feet.</i>	<i>Cubic meters.</i>	<i>Cubic meters.</i>
Abra					1,882				
Albay					778				
Antique					1,276				
Bataan					1,643				
Batangas				26,830	460		1,366		
Benguet					2,913				
Bohol									
Bulacan					12,811				7,223
Cagayan					750				
Camarines					2,183				
Capiz				650	1,811				
Cavite									
Cebu	1,074	180							
Cotabato					138				
Davao			803						
Ilocos Norte					1,240				
Ilocos Sur									
Iloilo					77	1,125		1,315	
Isabela							39		
Jolo									
Laguna				900	2,070		599		
Lepanto									
Leyte		576		53,200					
Masbate	99,218				4,627				
Mindoro				97,649	2,025				
Misamis					18,844				
Negros Occidental		48,855		5,600	30,643		64,608		
Negros Oriental									
Nueva Ecija					5,923		8,703	4,773	
Pampanga				6,000	2,765		15,483	32,721	9,304
Pangasinan									
Paragua									
Rizal				1,000			4,231	4,355	
Romblon	14,201	1,240		1,890					
Samar				2,000					
Sorsogon									
Surigao		1,150							
Tarlac					958		258,730	883	
Tayabas	637,787	48			5,046				
Union									
Zambales		1,680		2,050	25,789				
Zamboanga				33,489	26,387				
Total	752,280	53,529	803	230,758	153,029	1,125	353,759	51,270	9,304

There were imported into the Philippines during fiscal year ending June 30, 1903, 113,483 cubic feet by commercial liners; 6,841,207 feet B. M., free entry for Government, and 4,746 foot-tons, free entry for Government. Exported, 87,000 feet B. M.

Groups and varieties, arranged in order of quantities, cut during the fiscal year ending June 30, 1903.

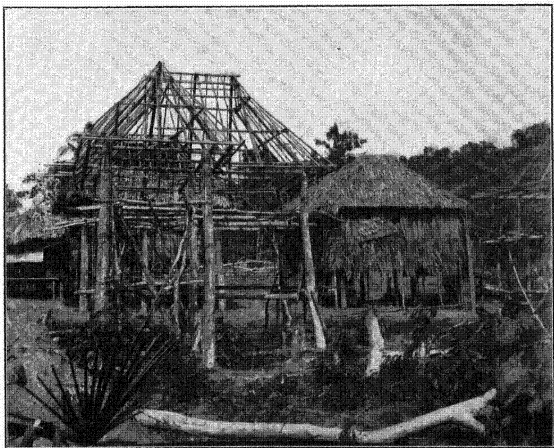
Group.	Number of varieties.	Cubic feet.	Government valuation (Mexican).
III (third)	797	2,391,526	\$71,745.78
II (second)	46	935,768	74,861.44
S (superior)	11	873,819	122,334.66
IV (fourth)	102	300,339	6,006.78
I (first)	15	173,420	17,342.00
V (fifth)	13	65,866	658.66
Total	984	4,740,738	292,949.32



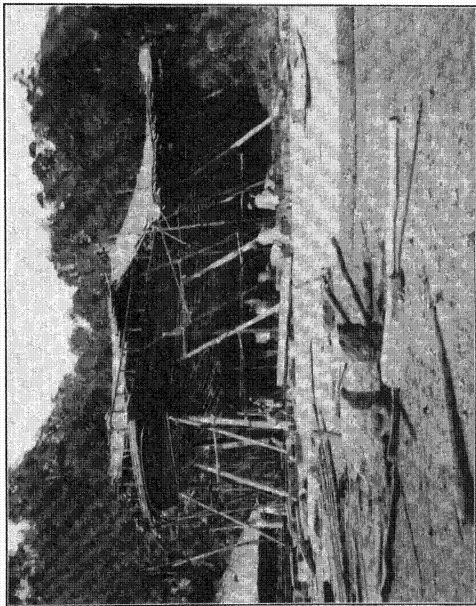
RAFT IN PROCESS OF CONSTRUCTION.



DRYING HOUSE FOR MAKING COPRA, SAN RAMON FARM.



HOUSE CONSTRUCTION IN THE PROVINCES.



BOAT BUILDING IN TAYABAS PROVINCE.

Groups and varieties, arranged in order of quantities, cut during the fiscal year ending June 30, 1903—Continued.

Group.	Varieties.	Cubic feet.
III.....	Lauan	704, 109
III.....	Apitong.....	594, 313
II.....	Guijo	326, 776
S.....	Molave.....	297, 704
S.....	Yacal	178, 180
S.....	Narra	128, 111
II.....	Tanguile.....	121, 853
S.....	Ipil	107, 195
	Eight varieties.....	2, 458, 241
III.....	Sacat.....	88, 053
II.....	Macaasin.....	60, 944
S.....	Dungon.....	59, 597
IV.....	Malasantol.....	58, 528
S.....	Tindalo.....	52, 465
IV.....	Balacat.....	51, 498
	Six varieties.....	371, 085
III.....	Supa	47, 699
S.....	Calantas.....	47, 650
II.....	Amuguis.....	46, 391
III.....	Malaanonang.....	45, 895
III.....	Calumpit.....	43, 091
I.....	Acle	41, 901
III.....	Balinhasay.....	39, 058
I.....	Betis	35, 773
II.....	Dolitan	33, 070
II.....	Palo maria.....	32, 498
II.....	Mangachapuy.....	32, 270
I.....	Bansalaguin.....	30, 499
	12 varieties.....	475, 795
IV.....	Malabonga.....	29, 448
II.....	Banaba	27, 513
III.....	Palosapis.....	21, 980
III.....	Panao.....	18, 055
II.....	Malaruhut.....	16, 867
IV.....	Malacauayan.....	16, 738
II.....	Banuyo	15, 811
I.....	Batitinan.....	15, 278
II.....	Aranga	13, 692
V.....	Palma	13, 488
IV.....	Anam	13, 283
V.....	Bacauan	12, 559
V.....	Anahao	12, 329
IV.....	Bogo	12, 317
	14 varieties.....	239, 358
	12 varieties.....	475, 795
	6 varieties.....	371, 085
	32 varieties.....	1, 086, 238
	8 varieties.....	2, 458, 241
	40 varieties.....	3, 544, 479
	944 varieties.....	1, 196, 259
	984 varieties.....	4, 740, 788

Third group, 50.4 per cent of total.

Eight varieties, 51.8 per cent of total.

Forty varieties, 74.7 per cent of total.

Lauan of the third group, 14.8 per cent of total.

Groups and varieties, arranged in order of quantities, cut during the fiscal year ending June 30, 1903—Continued.

No. of species.	Species.	No. cubic feet.	Total cubic feet.
	<i>Superior group.</i>		
11	Calantas.....	47,650	873,819
	Camagon.....	2,071	
	Dungon.....	59,597	
	Ebano.....	413	
	Ipil.....	107,195	
	Mancono.....	432	
	Molave.....	297,704	
	Narra.....	128,111	
	Teca.....	1	
	Tindalo.....	52,465	
	Yacal.....	178,180	
	<i>First group.</i>		
15	Acle.....	41,901	173,420
	Alahao.....	8,314	
	Alintatao.....	5,863	
	Anubing.....	4,234	
	Bansalaguin.....	30,499	
	Baticuling.....	4,481	
	Batitinan.....	15,278	
	Bayuco.....	5,882	
	Betis.....	35,773	
	Calamansanay.....	9,850	
	Camayuan.....	1,476	
	Camuning.....	419	
	Cubi.....	6,999	
	Lanete.....	2,397	
	Malatapay.....	54	
	<i>Second group.</i>		
46	Amuguis.....	46,391	935,768
	Aranga.....	13,692	
	Banaba.....	27,513	
	Banuyo.....	15,811	
	Dolitán.....	33,070	
	Guijo.....	326,779	
	Macaasin.....	60,944	
	Malaruhát.....	16,867	
	Mangachapuy.....	32,270	
	Palo maria.....	32,498	
	Supa.....	47,699	
	Tanguile.....	121,853	
	Other, 34 species.....	160,381	
	<i>Third group.</i>		
797	Apitong.....	594,313	2,391,526
	Balinhasay.....	39,058	
	Calumpit.....	43,091	
	Lauan.....	704,109	
	Malaanonang.....	45,895	
	Palosapis.....	21,980	
	Panao.....	18,055	
	Sacat.....	88,053	
	Other, 789 species.....	836,972	
	<i>Fourth group.</i>		
102	Anam.....	13,283	300,339
	Balacat.....	51,498	
	Bogo.....	12,317	
	Malabonga.....	29,448	
	Malasantol.....	58,528	
	Malacauayan.....	16,738	
	Other, 96 species.....	118,527	
	<i>Fifth group.</i>		
13	Anahao.....	12,329	65,866
	Bacauan.....	12,559	
	Palmas.....	13,488	
	Other, 10 species.....	27,490	
984	Total.....		4,740,738

Amounts of public timber cut, arranged by months.

Month.	Cubic feet.	Month.	Cubic feet.
1902.		1903.	
July	357,509	March	398,071
August	215,197	April	511,138
September	263,914	May	569,001
October	408,102	June	580,256
November	345,862	Total	4,740,738
December	401,465	Gratuitous	153,029
1903.		Private land	353,759
January	355,391	Grand total	5,247,526
February	334,832		

PRICES.

Prices of logs laid down on the beach vary from 6½ cents, Mexican, per cubic foot of low-grade woods, up to 30 cents for superior-group woods. The average for 20-foot logs of superior-group woods is less than 20 cents per cubic foot (Spanish).

Transportation.—Transportation charges for logs to Manila average about as follows:

	Cents Mexican.
From Masbate	cubic foot.. 40
From Pitogo, Tayabas	do... 30
From Guinayangan, Tayabas	do... 35
From Subig, Zambales (by raft)	do... 5

Where logging companies use their own boats the cost of transportation averages about one-third of the above charges.

The average price per log delivered in Manila, as given by local firms in bidding on an order for timber by the forestry bureau, is as follows:

[United States currency.]

Class.	In the log.	Sawed.	Class.	In the log.	Sawed.
	<i>Cubic foot.</i>	<i>Cubic foot.</i>		<i>Cubic foot.</i>	<i>Cubic foot.</i>
Molave	\$0.75	\$1.60	Dungon	\$0.72	\$1.53
Guijo .....	.44	1.30	Betis .....	.72	1.53
Yacal .....	.70	1.50	Dungon-late .....	.70	1.50
Tanguile .....	.32	1.00	Acle .....	.73	1.54
Supa .....	.42	1.28	Calumpit .....	.30	1.20
Narra (red and white) .....	.83	1.67	Aranga .....	.70	1.50
Lauan (red and white) .....	.26	.54	Calantas .....	.60	1.20
Nato .....	.34	.70	Bansalaguin .....	.45	1.10
Amuguis .....	.35	.90	Manapo .....	.42	1.25
Ipil .....	.68	1.48	Apitong .....	.33	.62
Tindalo .....	.75	1.55	Bancal .....	.55	1.10

Other prices quoted are as follows:

	U. S. currency.
Molave, tindalo, and red narra	board foot.. \$0.18
Ipil, yellow narra, acle, and dungon	do... .16
Guijo and supa	do... .09
Tanguile	do... .07
Apitong	do... .06
Lauan	do... .04

The prices paid by the insular purchasing agent for native lumber during the months of May, June, and July of this year are as follows:

[United States currency.]

Variety.	Per board foot.	Per cubic foot.	Per 1,000 feet.
	Cents.		
Lauan			$\left\{ \begin{array}{l} a \$38.00 \\ b 125.00 \end{array} \right.$
Guijo	6½ to 10	\$1.50 to \$1.90	
Molave	15 to 15½	1.75	
Teak	12		
Apitong	6		
Red narra	16		c 173.50
Yacal	14½	1.50 to 1.75	
Tanguile			53.00
Ipil (clear)		1.75	
Nato (clear)			125.00
Dungon		1.53½	
Aranga		1.80	

a Rough.

b Clear.

c 20 inches wide, clear.

The prices quoted in the Manila newspapers are as follows (United States currency):

	Per M feet.
Lauan, rough	37.50
Apitong, rough	50.00
Amuguis, rough	60.00
Macaasin, rough	70.00
Guijo, rough	85.00
Yacal, rough	120.00
Ipil, rough	120.00
Molave, rough	140.00

Expenditures for the forestry bureau from July 1, 1902, to June 30, 1903.

[United States currency.]

Fiscal year.	Salary and wages.	Transportation.	Contingent.	Printing.	Total.
First quarter	\$17,408.47	\$1,875.00	\$2,304.61	\$586.25	\$22,174.33
Second quarter	19,500.00	1,875.00	3,923.75	468.80	25,772.55
Second half	41,927.64	2,320.83	2,257.01	1,750.00	48,255.48
Total	78,836.11	6,070.83	8,490.37	2,805.05	96,202.36

Expenditures for July and August, 1903.

Salaries and wages	\$17,140.47
Transportation	975.33
Contingent	1,664.66
Total	19,780.46

Revenues collected on forest products taken from public lands for the past three years.

[Mexican currency.]

Month.	1900-1901.	1901-2.	1902-3.
July	\$8,422.08	\$29,308.21	\$41,318.61
August	5,990.30	32,004.38	24,930.23
September	8,911.89	22,808.18	34,599.59
October	12,192.31	17,769.59	45,221.54
November	11,753.91	37,524.33	37,202.90
December	15,455.03	30,592.94	46,000.79
January	16,319.65	28,093.29	42,593.52
February	15,210.14	27,727.31	35,300.13
March	23,547.83	22,482.75	52,536.42
April	29,336.30	34,860.26	47,778.12
May	26,799.06	32,500.76	55,632.52
June	25,434.61	32,401.08	64,300.48
Total each fiscal year.....	199,373.11	348,073.08	527,414.85
Average	18,614.00	29,006.00	43,784.00

Grand total for three years, \$1,074,861.04.

Very respectfully,

GEORGE P. AHERN,
Captain, Ninth Infantry, Chief of Forestry Bureau.
 The SECRETARY OF THE INTERIOR,
Manila, P. I.

EXHIBIT I.

APRIL 24, 1903.

SIR: I have the honor to submit the following report of the trip made to Bayambang, Pangasinan, by the undersigned, for the purpose of granting gratuitous licenses to the needy residents of that town:

I left for Bayambang on the 6.10 a. m. train, Tuesday, April 21, and arrived at 1 p. m. Consulted with the presidente regarding the needs of the people whose homes were destroyed by fire, and obtained a list of the victims of the fire, amounting to 121 persons. Made arrangements that afternoon with the presidente to have the owners appear at the city hall the following morning for the purpose of questioning them as to the amount of timber desired by each. Assistant Forester Barredo arrived in Bayambang that evening.

On the morning of the 22d about three-fourths of the victims of the fire assembled at the city hall. From them I learned that the average amount of timber contained in the houses destroyed by fire was about 150 cubic feet per house. Of the 121 houses burned only 8 were wholly constructed of timber. A careful inspection of the list of 121 names was made, and with the assistance of Mr. Barredo, the presidente, and other municipal officers, the list was reduced to 62 needy residents, and gratuitous licenses granted to that number, of 200 cubic feet each, the licenses to expire July 21, 1903.

The 12,400 cubic feet granted will be cut within a radius of 6 kilometers of Bayambang. The species to be most cut, and which predominate in that jurisdiction, are manbog and caraol of the third and fourth groups, respectively.

In order to avoid any abuse of the gratuitous privilege granted the needy residents of that town on the part of the municipal officers or unscrupulous timber dealers, I imparted to the natives concerned, through an interpreter, the most important articles governing the gratuitous utilization of timber, and arrangements were made with the presidente to furnish the forestry official, on his next visit, a statement from each licensee of the amount and classes of timber cut. Attached is the certificate of the presidente showing the necessity for gratuitous licenses, with a list of the licensees.

In a conference had with the constructing quartermaster of the military post at Bayambang it was learned that no native timber would be used in the construction of the post buildings. In case native timber was to be used, that officer promised to notify the forestry official at Dagupan when the delivery of the timber would be made.

About 200 logs of the above-mentioned species were delivered by contractor and used for supporting the piles of American lumber. This is all the native timber that has been used at that post. A portion of the logs were used for posts for a few temporary buildings. Mr. Barredo obtained a list of the logs from the contractor, and payment of valuation will be made.

Left Bayambang at 7 a. m., April 23, and arrived in Manila at 2 p. m.

Very respectfully,

J. T. O'CONNOR,
In Charge of Licenses.

CAPT. GEORGE P. AHERN,
Chief of Forestry Bureau, Manila, P. I.

DEPARTMENT OF THE INTERIOR, FORESTRY BUREAU, MANILA, P. I.

Application for a timber license.

MANILA, P. I., May 27, 1903.

FORESTRY BUREAU, Manila, P. I.:

I hereby make application for a license to cut timber on the public lands in the province of Ambos Camarines, town of Ragay.

Location in town of timber, Pacolago, Catabangan, and Quilbay.

I am a resident of Manila, P. I.

I shall employ about 200 men for cutting and hauling timber.

My personal equipment for logging consists of carabaos, hemp, and rattan tackle, axes, saws, sleds, and rollers.

I cut last year under license 10,000 cubic feet of timber (individual license).

Amount of timber desired for cutting, 100,000 cubic feet.

Before cutting, I shall notify the local forestry official of the names and residences of my agents actually in charge of the logging operations. Each agent will carry with him a written authorization.

I will strictly comply with the forestry regulations and such rules, orders, and instructions as may be issued governing the cutting and disposition of timber, and will be responsible for the compliance with same of all parties operating under the timber license granted the undersigned.

CALVO & Co., *Applicants.*

Date, June 23, 1903.

Place, Nueva Caceres, Camarines.

REMARKS.—Juan Miguel, representative of Calvo & Co., has filed an application for timber license in same places in Ragay, which has been forwarded with recommendations and remarks. This license should not be granted unless the application of Juan Miguel is disapproved by the bureau, as they are both in the same interests. Would advise that Calvo & Co. be assigned to the north side of watershed of Quilbay River, watershed of Ragay River, below the town of Ragay, and territory between the Catabangan and Binahan rivers, from the coast 6 miles inland. Cutting of calantas, molave, batitinan, and ipil to be placed on prohibited list. Recommended for 60,000 cubic feet.

GEO. S. VAN WICKLE,
Forester, Forestry Bureau.

DEPARTMENT OF THE INTERIOR,
FORESTRY BUREAU.*Timber license.*

No. 678.

MANILA, P. I., July 1, 1903.

Licensee, Calvo & Co.
Resident of Manila.

Locality, north side of Quilbay watershed, Ragay watershed, south of town of Ragay, and between Catabangan and Binahan rivers.

Province, Camarines.

Remarks: To cut 60,000 cubic feet. Prohibited species, calantas, molave, batitinan, ipil.

Expires June 30, 1904.

R. C. BRYANT,
Chief Division of Forest
Management.

DEPARTMENT OF THE INTERIOR, FORESTRY BUREAU.

Timber license.

No. 678.

MANILA, P. I., July 1, 1903.

In accordance with existing law, a license is hereby granted Calvo & Co., residents of Manila, P. I., to cut not to exceed 60,000 cubic feet of timber in the public forests located at north side of Quilbay watershed, Ragay watershed, south of town of Ragay, and between Catabangan and Binahan rivers, in the province of Camarines.

Cutting of the following species is prohibited under this license: Calantas, ipil, molave, batitinan.

R. C. BRYANT,

Chief Division Forest Management.

This license expires June 30, 1904.

This license is granted pending legislation, and is subject to change.

With the exception of ebony, lanete, and camuning, the felling of trees of the superior and first groups of less diameter than 40 centimeters is prohibited.

The felling in the public forests of ylang ylang trees and those producing caoutchouc and gutta-percha is prohibited.

Tariff (subject to change).

Cents (local currency).

Superior group, per cubic foot.....	14
First group, per cubic foot.....	10
Second group, per cubic foot.....	8
Third group, per cubic foot.....	3
Fourth group, per cubic foot.....	2
Fifth group, per cubic foot.....	1

This license does not permit the felling of timber on land claimed by private parties, even though held under mere color of title.

DEPARTAMENTO DEL INTERIOR, FORESTRY BUREAU, MANILA, P. I.

Solicitud para licencia gratuita.

PAETE, LAGUNA, P. I., June 2, 1903.

FORESTRY BUREAU, Manila, P. I.:

Por la presente solicito una licencia gratuita para cortar maderas en los terrenos del Estado de la provincia de Laguna, pueblo de San Antonio.

Lugar del pueblo en que existe la madera Lamao.

Soy residente de Paete.

Las especies y cantidad de maderas necesarias son:

Clases de madera.	Dimensiones.			Cubica- ción.
	Length.	Width.	Thick- ness.	
	Feet.	Inches.	Inches.	
2 takpú	16	10	10	32
4 mayapis	18	8	6	35
4 bancal	24	12	12	138
6 dalingdingan	20	6	6	43
30 palma brava	16	8	Cir.	14
Total cubic feet.....				262

Antes de cortar notificaré al oficial forestal local de Paete los nombres de mis representantes realmente encargados de las operaciones. Cada encargado llevará consigo una autorización por escrito.

Cumpliré estrictamente con el reglamento forestal, y tales reglas, órdenes é instrucciones que se promulguen gobernando el corte y disposición de las maderas; y seré responsable para el cumplimiento de las mismas por todas las personas que trabajen bajo la licencia gratuita de maderas que se conceda al que suscribe.

Tanto el que suscribe como los que cortan por él, no poseén licencia ordinaria de maderas.

JUAN BAISAS, *Solicitante*.

Fecha, June 6, 1903.
Lugar, Paete, Laguna.

OBSERVACIONES.—The applicant is a needy resident of this town, who desires to use the timber to build his house. The town assessment roll shows him as such. This application is approved.

MANUEL RIVERA, *Ranger*.

DEPARTMENT OF THE INTERIOR, FORESTRY BUREAU.

Gratuitous license.

No. 165.

MANILA, P. I., July 11, 1903.

Licensee, Juan Baisas.

Resident of Paete, Laguna.

Locality, San Antonio.

Town, San Antonio.

Province, Laguna.

Remarks: To cut 262 cubic feet of timber for construction of his house.

Expires January 10, 1904.

R. C. BRYANT,
Chief Division Forest Management.

DEPARTMENT OF THE INTERIOR, FORESTRY BUREAU.

Gratuitous license.

No. 165.

MANILA, P. I., July 11, 1903.

In accordance with existing law a license is hereby granted Juan Baisas, resident of Paete, Laguna, to cut 262 cubic feet of timber in the public forests located in the town of San Antonio, province of Laguna, for construction of his house.

R. C. BRYANT,

Chief Division Forest Management.

This license expires January 10, 1904.

This license is granted pending legislation, and is subject to change.

Trees of the superior and first groups shall not be cut under a gratuitous license.

The felling in the public forests of ylang ylang trees and those producing caoutchouc and gutta-percha is prohibited.

Cutting is limited to 262 cubic feet.

This license does not permit the utilization of forest products on land claimed by private parties, even though held under mere color of title.

[*Productos forestales secundarios*.—Leñas, carbón vegetal, maderas tintóreas, nigue, cascalote, gomas y resinas, aceites, diliman, orquídeas, estacas para corrales de pesca, etc., madera para zuecos, miel de abejas, cera.]

DEPARTAMENTO DEL INTERIOR, FORESTRY BUREAU, MANILA, P. I.

Solicitud de licencia para aprovechar productos forestales secundarios.

CALAUAG, TAYABAS, P. I., June 20, 1903.

FORESTRY BUREAU, Manila, P. I.:

Por la presente solicito una licencia para aprovechar los siguientes productos forestales secundarios, gums and resins, tanbark, rattan, en los terrenos del Estado en la provincia de Tayabas, pueblo de Calauag.

Lugar ó sitio del pueblo de los productos que deseo, within town limits.

Soy residente de Calauag, Tayabas.

Antes del aprovechamiento notificaré al oficial forestal local los nombres y residencias de mis representantes realmente encargados del aprovechamiento.

Cada encargado llevará consigo una autorización por escrito.

Cumpliré estrictamente con el reglamento forestal, y tales reglas, órdenes é instrucciones que se promulguen, gobernando el aprovechamiento de productos forestales; y seré responsable para el cumplimiento de las mismas por todas las personas que trabajen bajo la licencia que se conceda al que suscribe.

PEDRO PICA, *Solicitante*.

Fecha, June 24, 1903.

Lugar, Atimonan, Tayabas.

OBSERVACIONES.—This applicant gathered pili resin last year under the license granted to Nicolas Pica, his father. Desires whole district of town of Calauag. I recommend the license to be granted for the sitios Santa Rosa, Ilayan of Calauag. Quantity, up to 1,000 hundredweight of each product.

E. HAGGER, *Forester*.

DEPARTMENT OF THE INTERIOR, FORESTRY BUREAU.

License for minor forest products.

No. 234.

MANILA, P. I., July 1, 1903.

Licensee, Pedro Pica.

Resident of Calauag.

Locality, Santa Rosa, Ilayan.

Town, Calauag.

Province, Tayabas.

Remarks: To gather gums, resins, tanbark, and rattan.

[Leñas, carbón vegetal, maderas tintóreas, nigue, cascote, gomas y resinas, aceites, diliman, orquídeas, estacas para corrales de pesca, etc., madera para zuecos, miel de abejas, cera.]

R. C. BRYANT,

*Chief Division**Forest Management.*

Expires June 30, 1904.

DEPARTMENT OF THE INTERIOR, FORESTRY BUREAU.

License for minor forest products.

No. 234.

MANILA, P. I., July 1, 1903.

In accordance with existing law, a license is hereby granted Pedro Pica, resident of Calauag, Tayabas, to gather gums, resins, tanbark, and rattan in the public forests located at Santa Rosa and Ilayan, town of Calauag, province of Tayabas.

R. C. BRYANT,

Chief Division Forest Management.

[*Minor forest products.*—Leñas, carbón vegetal, maderas tintóreas, nigue, cascote, gomas y resinas, aceites, diliman, orquídeas, estacas para corrales de pesca, etc., madera para zuecos, miel de abejas, cera.]

This license expires June 30, 1904.

This license is granted pending legislation, and is subject to change.

The felling in the public forests of ylang ylang trees and those producing caoutchouc and gutta-percha is prohibited.

Tree species of the third, fourth, and fifth groups only are allowed to be cut for firewood and charcoal.

Only those products specified on the face of this license, in handwriting, shall be gathered hereunder.

TARIFF (SUBJECT TO CHANGE).

Firewood.—First-class ("rajas"), composed of pieces 75 centimeters to 1½ meters in length, 20 to 40 centimeters in circumference, \$1, local currency, per thousand "rajas," if destined for home consumption; \$2, local currency, per thousand, if for export. Second-class, pieces of small size, 20 cents per cubic meter if for domestic consumption; 40 cents per cubic meter if for export.

Orchids.—Ten cents each when kept in the islands, 20 cents each when exported.

All other minor forest products will be charged for at the rate of 10 per cent of their market value in Manila.

This license does not permit the utilization of forest products on land claimed by private parties, even though held under mere color of title.

RECOMMENDATIONS ON POLICY, ORGANIZATION, AND PROCEDURE FOR THE BUREAU OF FORESTRY OF THE PHILIPPINE ISLANDS.

YOKOHAMA, JAPAN, *December 16, 1902.*

SIR: As the result of a rapid survey of the forests of the Philippine Islands and pending the preparation of my formal report to the honorable the Secretary of Agriculture, I have the honor, in accordance with your expressed desire, to submit the following statements and recommendations. Captain Ahern has joined me in preparing the chapters on Organization, Philippine forest school, and Philippine forest exhibit, and is in full agreement with me as to the chapters on Forest policy and Conduct of business.

Very respectfully,

GIFFORD PINCHOT,
Forester.

His Excellency WILLIAM H. TAFT,
Civil Governor of the Philippine Islands, Manila, P. I.

I. FOREST POLICY.

The cardinal facts in the forest situation are in my view the following:

1. The forests of the islands are immensely rich in quality and amount of timber, of great extent, and admirably adapted for practical forestry.

2. The internal condition of the forests, the degree of governmental control, the efficiency and spirit of the insular forest service, organized by Captain Ahern, and the general economic situation combine to present the best opportunity for successful and profitable forest administration of which I have knowledge.

3. Lumbering in the islands has not changed in character since the Spanish administration and is still destructive to the forest.

4. Deficiencies of transportation and labor supply must for the present confine whatever destruction takes place to the most accessible and valuable parts of the forest.

5. Effective inspection and control of the widely scattered lumbering operations is made impossible at present by difficulties of communication and lack of personnel.

6. The regulation of lumbering so as to insure permanent supplies of the more valuable timbers is impossible at present for lack of a working knowledge of the conditions of natural reproduction.

7. A great development of forest industry in the islands is evidently at hand. If this development is not to be accompanied by serious, extensive, and permanent injury to the forests, preparation by study and experiment must begin at once.

8. The use of timber in the islands is largely conditioned by the white ant.

9. The rubber and gutta-percha vines and trees of the southern islands are being extirpated with great and growing rapidity.

In view of these facts, I recommend:

1. That the attention of the technically trained men in the forest service be given for the present exclusively to the marking of timber, the inspection of lumbering on the ground, and the study of forest reproduction.

2. That the forest service be provided with a small steamer for its exclusive use. Without a steamer thorough inspection of lumbering operations is impossible, and the marking of trees to be cut, the control of local forest officers, and all silvicultural work must suffer greatly.

3. That the resources of the forest service be increased as rapidly as men can be found to meet the urgent needs inherent in the present situation.

4. That a revision of the forest law and the rules under it be prepared at once and put in force. Detailed recommendations under this head are in preparation.

5. That the number of licenses issued be limited (so far as the general welfare of the islands will permit) until cutting can proceed without forest destruction.

6. That the marking of the trees to be cut under license be undertaken at once, and be extended over all cutting in government forests as rapidly as possible.

7. That the government charge for timber on the stump be established, or continued, at the average rate of 6 per cent of the market value of timber in the log at Manila. This is less than half the corresponding charge for timber from the Government forest reserves in the United States.

8. That in certain provinces and districts where even the seed trees of valuable species have been and are being cut down, or for certain trees, the government charge for timber on the stump be raised in order to divert the lumber business to other regions, or other species, except where equivalent protection can be given by the enforcement of special rules.

9. That the recommendation of Commissioner Worcester for the creation of a government monopoly in rubber and gutta-percha be given immediate effect, and that the Tawi-tawi group of the Jolo Archipelago be made a permanent forest reserve for the protection and propagation of rubber, gutta-percha, and other forest trees.

10. That three experimental ranges of not less than 5,000 acres be set aside, in locations to be chosen hereafter, for the practical study of methods of reproducing the best timbers, for experimental forest planting, and for other sylvicultural work.

11. That the work of the timber-testing laboratory be continued along the general lines adopted by the Bureau of Forestry in the United States with the purpose—

First. To establish standards of strength and quality for well-known timbers.

Second. To make tests of timbers hitherto less used for comparison with these standards, in order to relieve the species most in use from the destructive demand now made upon them as well as to develop the timber resources of the islands.

Third. To ascertain what timbers, especially among those not now in use, are immune from the attacks of the white ant, and to devise means for the protection of timbers not immune.

12. That a trained forest entomologist be employed at once, to devote himself to the study of the white ant and the problem to which it gives rise.

13. That for the present the botanical work be continued only so far as may be necessary to establish the identity of sylviculturally important species and of the timbers tested.

14. That the enforcement of the regulations against the making of caingins be prosecuted with increasing vigor, with the assistance of the local authorities of the islands.

15. That the conditions for the use of public timber under gratuitous license be carefully defined.

16. That a school for native forest rangers be established in one of the experimental forests as soon as suitable instructors can be found.

17. That a regular series of grades be established for Filipino and American forest officers, with fixed pay and allowances; that it be established in order to facilitate the recruiting of suitable men for the work, and that the personnel be limited to Filipinos and Americans.

II. ORGANIZATION.

The following plan is recommended for the present organization of the bureau of forestry of the Philippine Islands. This plan is in most respects adapted for the permanent arrangement of the work. In some particulars, however, it will eventually require modification to meet the broader needs of larger work, and in others it is slightly in advance of the capacity of the present small force. These characteristics are entailed by the growing condition of the bureau.

ORGANIZATION OF THE PERSONNEL.

Controlling staff:

Chief of the bureau of forestry.
Assistant chief.
Chiefs of division.
Foresters.
Assistant foresters.
Inspectors.
Assistant inspectors.
Scientific assistants.
Instructors in the forest school.

Executive staff:

Clerical force.
Head rangers.
Rangers.
Assistant rangers.
Protective staff:
Head guards.
Guards.
Assistant guards.

ORGANIZATION OF THE WORK.

Office of the chief.
 Division of forest management.
 Division of inspection.
 Division of investigation.
 Division of records.
 Division of accounts.
 Division of forest management:
 Study of reproduction.
 Preparation of working plans and rules for cutting.
 Control and inspection of lumbering when force permits.
 Marking trees to cut.
 Division of inspection:
 Control of rangers.
 Licenses.
 Collection of revenue.
 Control of timber and forest produce after cutting and collection.
 Marking trees to cut.

Division of inspection—Continued.
 Legal affairs.
 Land registration.
 Land classification.
 Division of investigation:
 Strength, quality, and uses of timber.
 Timber preservation and protection.
 Identification of species.
 Collections and exhibits.
 Division of records:
 Correspondence.
 Records and files.
 Property and supplies.
 Quarters.
 Division of accounts:
 Pay.
 Transportation.
 Field expenses.
 Forest school.

The marking of trees to be cut and the designation of other forest products, assigned in this plan both to the division of forest management and to that of inspection, should ultimately be exclusively in the hands of the latter through its executive staff in the field. Pending the complete organization of the force it will have to be done by such officers, either foresters, inspectors, or rangers, as are capable of executing it and available for the work. Without marking there can be no effective check on cutting. Its introduction and gradual extension throughout the islands at the earliest possible moment is therefore of the very first importance.

GRADES AND PAY.

The table of grades and pay given below is recommended for the personnel of the bureau of forestry. This recommendation is made subject to the provisos, first, that the outline here submitted be filled out by promotion and appointment only so rapidly as the actual needs of the service require; and, secondly, that the table be made public as a means of securing desirable men from the United States by offering them definite possibilities of advancement. Without the latter this outline would fail of its principal purpose.

The adoption of this table of grades and pay should of itself entail no promotions whatever. It is intended merely as a frame, and should be filled only by the normal growth of the service.

Two statements should be joined to this outline whenever it is made public: First, that normal promotions will not exceed one grade on the table per year of actual service in the islands, and may often fall below it. Secondly, that appointees sent out to the islands by the Government are required by law to refund the cost of their transportation if in less than two years they separate themselves from the service without the approval of their immediate chief. (This statement should be made to conform to the language of the civil-service law, which at the moment we are unable to consult.) The grade and pay of chiefs of division have been omitted from the outline in order to avoid difficulties of administration which might otherwise arise.

The adoption of the proposed table of grades and pay at this time will be valuable. While the necessity for modifying it is certain to occur, its general character will doubtless be retained.

Table of proposed grades and pay.

Controlling staff.	
Chief of bureau	\$5, 000
Assistant chief	3, 500
Director of forest school	2, 400
Instructor in forest school	1, 600
Do	1, 208
Forester	2, 400
Do	2, 200
Do	2, 000
Do	1, 800
Do	1, 600

Controlling staff—Continued.

Assistant forester	\$1,400
Do	1,200
Do	900
Inspectors	2,400
Do	2,200
Do	2,000
Do	1,800
Do	1,600
Assistant inspectors	1,400
Do	1,200
Do	900
Executive staff:	
Head ranger	900
Do	840
Do	720
Ranger	600
Do	540
Do	420
Assistant ranger	300
Students in forest school	200
Chief clerk	1,800
Accountant	1,800
Mail clerk	1,600
Law clerk	1,400
Translator	1,400
Property clerk	1,600
Do	900
Clerk	1,800
Do	1,600
Do	1,400
Do	1,200
Do	1,000
Do	900
Do	840
Do	720
Do	600
Do	540
Do	420
Do	350
Do	200
Stenographer	1,600
Do	1,400
Do	1,200
Foreman of workshop	1,200
Skilled laborer	900
Do	480
Do	360
Do	240
Protective staff:	
Head guards	240
Guards	180
Assistant guards	150

PRESENT AND PROPOSED FORCE.

The following table shows the present force, the proposed additional force, and the total force to which we recommend the insular bureau of forestry should be increased during the calendar year 1903, in order to meet the urgent needs of the forest work in the islands.

Attention is called to the immediate necessity for removing the accountant from the list of inspectors and for giving him the proposed increase of \$200 in salary on the 1st of January.

In spite of the notable reduction in office work which should follow if the recommendations made in Chapter IV are carried out, the work of the bureau urgently requires one additional clerk at \$1,600, one at \$1,200, and one stenographer at \$1,200. The saving in clerical labor will fall chiefly on work now done by Filipinos. The increase just mentioned provides (1) for the promotion of the present record clerk

(one of the oldest members of the bureau) from \$1,200 to \$1,400, and perhaps to \$1,600 by January 1, 1904; (2) for a clerk to the accountant; (3) for one stenographer for the divisions of forest management and inspection together.

The force of the bureau must necessarily increase if it is to keep pace with the development of the forest resources of the islands. It is especially to be noted that increase of force has meant in the past, and will mean in the future, a still larger increase of revenue.

Table of present force and additional and total force recommended for the calendar year 1903.

Present force.	Additional force.	Total force.	Cost.
1 chief.	3 foresters, at \$1,600.	1 chief.	
1 assistant chief, \$3,000.	3 assistant foresters, at \$900 to \$1,400.	1 assistant chief, \$3,000.....	\$3,000
6 foresters, at \$2,400.		6 foresters, at \$2,400	14,400
		3 foresters, at \$1,600	4,800
		3 assistant foresters, at \$1,400.	4,200
4 inspectors, at \$1,800.	1 inspector, \$2,400.	1 inspector, \$2,400	2,400
6 assistant inspectors, at \$1,200	6 assistant inspectors, at \$1,400.	4 inspectors, at \$1,800	7,200
6 assistant inspectors, at \$900.	6 assistant inspectors, at \$1,200.	6 assistant inspectors, at \$1,400.	8,400
		12 assistant inspectors, at \$1,200.	14,400
		6 assistant inspectors, at \$900.	5,400
10 rangers (assistant foresters), at \$600.	4 head rangers, at \$900.	4 head rangers, at \$900	3,600
25 rangers, at \$420.	15 rangers, at \$420.	10 rangers, at \$600	6,000
40 rangers, at \$300.	35 rangers, at \$300.	40 rangers, at \$420	16,800
		75 rangers, at \$300	22,500
1 manager timber-testing laboratory, \$2,400.	1 assistant, \$1,800.	1 superintendent of testing, \$2,400.	2,400
6 collaborators, at \$480.		1 assistant, \$1,800	1,800
		6 collaborators, at \$480	2,880
1 chief clerk, \$1,800.	\$2,000.	1 chief clerk, \$2,000	2,000
4 clerks (translator, collector, law clerk, stenographer), at \$1,400.	1 accountant, \$1,800.	1 accountant, \$1,800	1,800
	1 assistant accountant, \$1,200	1 assistant accountant, \$1,200	1,200
5 clerks (record, statistician, property, botanist, manager workshop), at \$1,200.	1 clerk, \$1,800.	1 property clerk, \$1,600.....	1,600
	1 clerk, \$1,600.	1 clerk, \$1,600	1,600
	2 stenographers, at \$1,200.	4 clerks, at \$1,400	5,600
		5 clerks, at \$1,200	6,000
		2 stenographers, at \$1,200....	2,400
4 clerks, at \$900.	6 clerks (Aparri, Iloilo, Nue Caceres, Tarlac, Zamboanga, and school), at \$300.	4 clerks, at \$900	3,600
2 clerks, at \$600.		2 clerks, at \$600	1,200
6 clerks, at \$300.	2 skilled laborers, at \$480.	12 clerks, at \$300	3,600
1 draftsman, \$360.	3 skilled laborers, at \$360.	1 draftsman, \$360	360
2 messengers, at \$150.	3 skilled laborers, at \$240.	3 messengers, at \$150	450
1 skilled laborer, \$900.	1 messenger, \$150.	1 skilled laborer, \$900	900
2 skilled laborers, at \$480.		4 skilled laborers, at \$480....	1,920
3 skilled laborers, at \$360.		6 skilled laborers, at \$360....	2,160
3 skilled laborers, at \$240.		6 skilled laborers, at \$240....	1,440
140	95	235	158,010

INSPECTING STEAMER.

The following statement deals with the acute present necessity for the use of one or more steamers in the inspection work of the bureau of forestry, together with an outline of one of the necessary trips.

The most urgent duties of the bureau of forestry are three:

First, to study the reproduction of the forest in order to ascertain and apply methods of conservative lumbering in place of the present destructive methods.

Second, to collect the revenue.

Third, to inspect. Upon the thoroughness of inspection the efficiency of every phase of the service outside of Manila chiefly depends. Effective inspection is impossible without reliable means of communication at the disposal of the bureau of forestry. Such means steam vessels alone can supply.

Inspection is practically impossible under the conditions which now obtain. Months are wasted by inspecting officers where with better communication weeks only would be required. The work of the majority of the rangers throughout the islands can now be controlled only through the medium of their own reports, a method notoriously uncertain in forest work. There is urgent and immediate need for a steamer.

Example of use of inspecting vessel.—This trip is based on the actual needs of the service at the present time, and would be made at once if a vessel were available. Upon it the steamer would carry two inspectors, one field party of two men for studies of reproduction, and supplies and mail for two similar field parties already in the field. Leave Manila at night. Ternate, 19 licenses; stop twelve hours. Batangas, local office, 19 licenses; stop thirty-six hours. Puerto Galera (Mindoro), local office, 12 licenses; stop twelve hours. Boac (Marinduque), 4 licenses; stop twelve hours. Lucena (local office), Pagbilao, Pagsabangan, Laguimanoc, Unisan, 64 licenses; stop four days. Pitogo and adjacent places, 1 company license and 44 individual licenses; land the field party; stop thirty-six hours. Guinayangan and territory at head of Ragay Bay, 21 licenses; drop one inspector (who will inspect this neighborhood, proceed by trail to Nueva Caceres, and rejoin the vessel on her return at Pasacao), and land supplies for field party; stop six hours. Dalupaon and Pasacao, 1 company license and 5 individual licenses; land supplies for field party; stop three days. San Pascual (Burias), 6 licenses; stop one day. San Jacinto (Ticao), 2 licenses; stop one day. San Fernando (Ticao), 5 licenses; stop one day. Masbate (Masbate), 16 licenses; stop one day. Sorsogon, 9 licenses; stop one day.

From Sorsogon the inspector should proceed to Legaspi, either overland, as in heavy weather, or by sea, if that is best. From Legaspi or Sorsogon the steamer should return to Manila, stopping at Pasacao to pick up the inspector left at Guinayangan.

The stops indicated would consume from seventeen to twenty days. With liberal allowance for running time, it is believed that such a trip should ordinarily be completed within thirty days, and that in actual practice, barring delays from exceptionally heavy weather, it would never exceed thirty-five.

Economy of maintenance and facility and speed in landing passengers point strongly to a small steamer for this service. The opinions of naval officers of experience in handling small gunboats in these waters seem to indicate unmistakably that a wooden vessel of 250 to 300 tons, with a speed of from 8 to 10 knots, would be as safe as any steamer, while she would be admirably suited to the use of the forest service.

There would be little reason for sending such a steamer into waters known to be very rough. Since the present need for inspection already much exceeds the possible service of one steamer, the bureau of forestry would necessarily supplement its own means by using the coasting steamers of the Commission. For example, such inspection as might be required during the northeast monsoon on the east coast of the Archipelago, where very little timber is cut, could be made by the regular steamers.

Occasional delays from heavy weather would be greatly preferable to the expense of a large vessel. If two boats of the sort described could be substituted for a single ship of the size ordered by the Commission for insular communication, one of them to be stationed at Manila and the other at Iloilo, the bureau of forestry would attain a control of its own work in the field which now it lacks, but which is indispensable for the right conduct of its work and the perpetuation of the forests.

III. CONDUCT OF BUSINESS.

Under the necessity for immediate action at the formation of the bureau of forestry, many of the Spanish methods of doing business were necessarily continued in operation. Later on it was found difficult to change them, both because of the training of the Filipino clerks and because of rules and methods prescribed during the military occupation. Nevertheless, many such changes have been made, greatly to the reduction of routine. Other changes are now in progress, and others, as will be indicated by the accompanying statement, are still required. Great emphasis should be laid on all labor-saving methods and devices, and red tape should be reduced to the lowest practicable amount.

Correspondence.—All mail should be received, receipted for when necessary, opened, recorded, and distributed by the mail clerk in the following manner:

A letter upon being opened by the mail clerk should be stamped first with a duplicating numbering stamp, and secondly with a dating stamp bearing the legend "Received by mail clerk," together with initial letters to indicate the chief of bureau and the different divisions to which the letter may be referred, and brief directions for its treatment, such as "For reply," "For reply and signature of chief," "For memorandum of reply." He will then check with a pencil the division to which the letter is referred and the action desired. Both of these stamps should at the same time be struck in a book, and the dating stamp should be checked to correspond with the checking on the letter. A complete record of the reference will thus be made.

Upon its receipt in any division, each letter should be struck with a rubber stamp to show the date and the name of the division. At the end of each day the stenographer of each division should report to the mail clerk the numbers of the letters

disposed of. Any letter the number of which the mail clerk has not checked off within thirty-six hours after its receipt should be made the subject of special inquiry.

At present all correspondence passes under the eye of the chief before being distributed to the various divisions. Letters should go direct to the various divisions from the mail clerk. It is recommended that the completed replies, accompanied by the letters and all other papers necessary to an understanding of each case, be submitted, as at present, to the chief of the bureau, and in addition that no communication be permitted to leave the bureau until it has received his initials by rubber stamp to indicate his approval. Each letter should, as at present, be initialed by the writer and the stenographer, and should further bear the initials of the proper clerks to show that any inclosures are already in the envelope and the envelope properly addressed, and that any promises contained in the letter, such as the mailing of bulletins or the addition of a name to the mailing list, have already been carried out or that active steps to that end have been taken.

Upon return of a letter for filing to the mail clerk, it should be checked with the name and address, but nothing more. The briefing of the letters should be entirely omitted, and the making of reference cards should be reduced to the utmost limit of safety. Nine-tenths of the material for which cards are prepared is never called for.

Licenses.—Forms of applications for licenses, at present six in number, should be reduced to four. Forms of licenses, at present likewise six in number, should be reduced to four, namely, timber, gratuitous, miners', and miscellaneous. Every license should bear full specific details as to the forest products to which it entitles the holder, and should be pasted in a small book containing the forest law and the regulations under it.

The license clerk should be kept constantly informed of any fines or penalties for serious forest offenses inflicted upon any licensee, or upon any man who may possibly hereafter apply for a license. He should make a record of such names in his alphabetical list of applications and licenses granted, which should be kept as follows: Immediately upon receipt of an application a card should be made out for the alphabetical card index. If the license is refused, nothing further is required; if it is granted, entry to that effect should be made on the card, and its right upper corner should be touched with red ink. Upon the infliction of any penalty for serious infraction upon the license, the left upper corner should be touched with black ink, and record should be made on the card. Since the license-record book contains all the information now given on the two other series of cards they should be abolished. At the end of the year the amount cut under every license should be entered on its card. Records of licenses subsequent to the first should be entered on the same card until a second is added for lack of room.

It is highly important that any information likely to influence the issuance of a license should be entered on a card, whether it refers to an applicant, a licensee, or a man whose name is not yet on the index. In particular, the recording of trespasses against the rules and regulations on the cards should be accurate and complete, and no license should ever be issued until after full consultation of the index. The amount cut under any license to date should be known to the license clerk before granting another to the same licensee. With the growth of the business of the bureau of forestry this card index will become one of its indispensable records.

Manifests.—The papers issued by the bureau of forestry to authorize the movement of timber or other forest products, to insure payment therefor, and to permit its discharge, should be limited to two—first, a manifest, and second, an order of discharge. Each manifest should be written on the typewriter or with indelible pencil, and two carbon copies should be prepared at the time of writing—one for filing in the office of the ranger who fills out the manifest and one for immediate forwarding to Manila. Each manifest should contain a blank space for the receipt of the provincial treasurer or other receiving officer.

At present a timber merchant who pays the government charge at Manila comes first to the bureau of forestry with his manifest and is given an order of payment. With that order he crosses the Pasig River to the office of the collector of internal revenue, pays him money and takes a receipt, with which he returns to the bureau of forestry. There he receives an order of discharge, and perhaps crosses the Pasig River for the fourth time if his place of business is on the other shore. It would greatly facilitate matters if the money could be paid to the insular treasurer in the intendencia building.

A single ledger will be sufficient to register manifests of timber cut on private lands, in place of the separate book for each province at present in use.

Closer relations between the officers in charge of the manifests and the license clerk are extremely desirable. They are provided for in the recommendations made elsewhere for the organization of the bureau.

Registration of titles.—It is now customary to make abstracts of the boundaries from private titles submitted to the bureau of forestry for registration. In order to increase the value of the record and to reduce clerical labor in the bureau, I recommend that private owners be required to file with the chief of the bureau of forestry certified copies of their descriptions of boundaries, that the abstracts of boundaries be omitted from the title-record book, and that it be otherwise simplified in minor details.

Local forest offices.—The system of records in local forest offices will require still further modification from Spanish methods, in order to reduce the clerical labor of men who should be much in the field. Two, or at most three, books, in addition to stubs of papers issued, will be sufficient.

Office routine.—It is strongly recommended that a concise statement of the method of doing business by each responsible officer on the office force and by each chief of division be prepared at once for the saving of effort, the reduction of red tape, the information of subordinates, and the guidance of possible successors.

IV.—PHILIPPINE FOREST SCHOOL.

The following plan is for the school for subordinate forest officers already contemplated by the Philippine Commission:

The proposed school should be located near Cobcogan, in the province of Bataan, about 20 miles from Manila, provided a forest of from 5,000 to 10,000 acres can be set aside there for use in practical instruction. This location is recommended for the following reasons:

(1) It is easily accessible from Manila and but little off the regular run of the launches from Manila to Mariveles.

(2) The low country, now covered with scrub, offers excellent ground for the school buildings and for the forest nurseries.

(3) The forest contains on the lower levels areas severely cut over, higher up along the trails areas from which banca timber alone has been removed and off the trails the untouched virgin forest.

(4) The forest is composed of comparatively few species, a large proportion of which have excellent reproduction. It is therefore admirably suited for purposes of instruction.

(5) Ripe trees of merchantable species are plentiful and fairly accessible, and forest management may be practiced and taught under favorable circumstances.

(6) Several patches of treeless land at different altitudes on the mountain side are excellently adapted for experimental plantations.

(7) The Sierra de Mariveles reaches an altitude high enough to cover every zone from sea level through and beyond the merchantable forest, and the effect of altitude on the distribution of species is well marked and very instructive.

(8) The topography, while steep above the foothills, is regular, and there should be comparatively little difficulty in building trails.

The forest school should be organized as a secondary or ranger school, and the school buildings should contain accommodations for 3 instructors, 30 students, 1 nurseryman, and 6 to 8 servants and assistants. There should be a small forest museum and a nursery for the growing of valuable native and exotic species, and to supply planting material. For the present the course of instruction should be completed within one year.

Students for the ranger school should be selected by local competitive examination, one student from each province. The papers of the successful candidate from each province should then be forwarded to Manila, and the best 30 men should be given appointments. The remainder should form an eligible list for filling any vacancies that may occur during the first six weeks of the school year. Each student should receive pay at the rate of \$15 gold a month during term time, including the Christmas and Easter vacations, but not the months of July and August. Each student should be required to bear the cost of books, stationery, subsistence, laundry, care of quarters, and other personal expenses.

The following calendar is recommended:

Beginning of the school year.....	February 1.
First term.....	February.
	March.
	April.
	May.
	June.
Summer vacation.....	July.
	August.

Second term.....	September.
	October.
	November.
	December.
	January 1-15.
End of the school year.....	January 15.
Vacations.....	Easter week.
	Christmas week.
	July.
	August.
	January 15-31.

The work of the school year should be distributed somewhat as follows: During February, March, April, and May, when the weather is dry, field work and lectures in the field should occupy the students. During June the time should be given to the elaboration of field notes and to examinations. September, October, and November should be occupied with instruction at the school, December with field work, and the first two weeks of January with the examinations and graduation.

The following course of instruction is recommended:

First term.....	Native trees and woods.
	Sylviculture.
	Conservative lumbering.
	Execution of field work.
	Woodcraft.
	Rules and regulations.
Second term.....	Native trees and woods.
	Sylviculture.
	Surveying and roadmaking.
	Elements of law.
	Forest distribution and resources of the Philippine Islands.
	Execution of office work.

It will be observed that the distribution alike of the school year and of the course of instruction is designed to acquaint the student first of all with practical work in the field, and to test his willingness and capacity for work in the woods before instruction in the lecture room begins.

The rough estimate of expenses given below does not include the services of men already in the bureau of forestry, several of whom would be called upon to assist temporarily in the courses of the school:

Preliminary estimate of expenses in gold for the ranger school.

1 director.....	\$2, 400
30 students, at \$150.....	4, 500
1 nurseryman.....	1, 200
1 assistant in nursery.....	300
1 assistant in nursery.....	150
1 janitor.....	180
1 general helper.....	150
Salaries.....	8, 880
Maintenance, repairs, trail and roadmaking, and miscellaneous expenses....	2, 000
First cost of installation.....	7, 000

Total expenses first year..... 17, 880

Rangers already in the service who stand in need of any part of the training provided in the school should from time to time, as the exigencies of the work may permit, be relieved from field work at their stations for a definite period, and ordered to Cobcaben, there to perfect themselves in their duties and to assist in the management of the forest and the training of the younger men.

During the initial years of the school it will be necessary to supply some instruction in English to such of the forest students as are not already proficient enough to follow the lectures easily. Such instruction should, however, form no part of the permanent curriculum.

V. PHILIPPINE FOREST EXHIBIT.

The following plan is not complete in matters of detail. It is intended simply to indicate the general character of the exhibit recommended, with such occasional details as seem necessary for that purpose.

The idea which should guide the formation of this exhibit is that of making it striking at the expense of completeness. For example, a collection of small pieces of every wood grown in the Philippine Islands would be complete, but it would attract no attention whatever, and would altogether fail of the principal object of this exhibit, which is to call attention to the forest resources of the islands. Completeness is impossible and should not be aimed at.

Large logs, large wood specimens, large transparencies, and large pictures are greatly to be desired. The public is already familiar with the usual methods of exhibition and installation. Unusual specimens and unusual yet suitable methods of installation will be necessary if the exhibit is to be remembered by those who see it. Wood specimens per se are of little value or interest, even to the specialist, under circumstances which preclude careful study.

Particular attention is directed to the efficiency of large colored transparencies and of bromide enlargements of great size. In an exhibit of this character it is recommended that labels be made as full and attractive as possible. By breaking up the text into paragraphs and giving comparatively full details concerning specimens of special interest, the usefulness of the whole exhibit will be greatly enhanced.

Both in order to bring the Philippine forest exhibit into harmony with the general plan at St. Louis, and to give it a degree of interest and instructiveness which it would otherwise necessarily lack, we recommend emphatically that specimens of manufactured products be accompanied in every possible instance by other specimens illustrating every stage of manufacture from the raw material down, and by large and numerous photographs to complete or supplement the story. This will be the keynote of the Government forest exhibit at St. Louis, and it should be kept constantly in mind in preparing the exhibit from the islands.

The United States Government forest exhibit will be housed in the general forest building and not in the Government building. If, as seems likely, it is found best to keep the Philippine forest exhibit with the other exhibits from the islands, then we recommend strongly that striking specimens of Philippine products, duplicates if necessary, be placed in the general forest building, with plain notices calling attention to and giving directions for reaching the rest of the exhibit.

SKETCH FOR THE PHILIPPINE FOREST EXHIBIT.

Housing.—To be shown in a bamboo and nipa house of native construction strengthened by hewn logs. Dimensions, 120 by 40 feet on the ground and high enough to accommodate transparencies, enlargements, etc.

The forests of the islands.—A transparent map, say 15 by 25 feet in size, painted on one or two sheets of plate glass and very plainly lettered to show all the islands and their forested or cleared condition. This map might profitably occupy one end of the building above the doors.

Smaller maps, also on glass, to show distribution of important commercial species and products by provinces.

The results of valuation surveys to be shown by tables and figures.

Transparencies and enlarged photographs to show typical, general, and interior forest views, large trees, heavy stands, and important commercial species. The relations of agriculture to forestry to be shown by transparencies and enlarged photographs and to include methods and effects of permanent clearing, the making of caingins, the relation of forestry to irrigation, etc. Amount of enlargement to depend upon quality of negative and importance of subject. In general, large pictures are very desirable.

One or two large specimens of balet, inclosing living and dead trunks, would be exceedingly attractive.

The Philippine forest service.—Administrative machinery; laws, rules, and regulations; forms and practice; the forest school, shown by photos and charts.

Logs, posts, and squared beams.—Six to ten very large log specimens of cabinet woods 6 to 12 feet long, preferably with a small section cut from the center and polished. Six to ten large hewn logs, say 20 feet long, with section cut from the center and surface polished, either of cabinet or construction timber, to be shown otherwise precisely as they came from the woods. Posts and piles to show durability in the soil and resistance to teredo. Beams from old houses, paving blocks, etc., to show durability. Specimens to show damage by white ant, teredo, and other enemies.

Logging methods, appliances, and tools.—Both usual methods and conservative lumbering (if the latter is sufficiently advanced) to be shown by models, preferably of Filipino wood carving, and by pictures wherever actual specimens can not be exhibited. Methods and appliances: Felling with the ax, squaring, nosing, and piercing, hauling by hand, hauling by carabao, timber slides, lighters, rafts. Tools: Bolos, axes, saws, skids, levers, ropes, and bejucos.

Sawed lumber.—To be shown by commercial samples, rough, planed and polished, and by large planks. Commercial lumber and dimension stuff of sizes and grades that can be furnished or contributed by mills in the islands, to bear the names of contributors and to include chiefly cabinet woods. Examples of construction timbers, such as lauan, molave, etc., to be included. These exhibits should show manufacture by steam and by hand, and should exhibit all the successive stages of manufacture from the round log to the square log (where squaring is customary), and the sawed, planed, and polished product. Large widths and lengths of clear lumber should be a prominent part of this exhibit.

Planks of the full width of the largest obtainable sound trees of commercial species, with the bark on, to be 6 or more inches in thickness and from 4 feet 6 inches to 8 feet or more in length. Two or three of these planks should be of the greatest length obtainable without too greatly reducing the width.

Manufactures of wood.—Wherever possible, photographs and specimens illustrating the origin, logging, collecting, or extraction, transportation, and every successive stage of manufacture of each specimen or series of specimens should be exhibited. This is of great importance, both for the usefulness of the exhibit and to bring it into conformity with the main lines of the general forest exhibit at St. Louis.

Construction: House building—Sills, beams, joists; flooring, both sawed and hewn; sash, doors, and blinds; frames for shell windows. Railroad and telegraph construction—Poles, ties, etc.

Transportation: Ship and boat building; one lauan banca 90 feet long, a Visayan banca, etc.; wagon building; harness woodwork.

Implements: For farming and dairying, woodworking tools, spinning and weaving, miscellaneous.

Trade uses: Cooperage, wood carving, split and shaved woods, turned articles, veneers.

Household uses: House furnishing and decoration—Tables, panels, beds, chairs, etc. Domestic economy—Palay pounders, washboards, hats, canes, pattens, etc.

Recreation: Musical instruments, games, toys, and amusements.

Bamboos, rattans, and bejucos.—Cutting, collecting, transporting, and preparation of bamboos and rattans. Full length samples of the various bamboos—flag poles, etc.

Construction: Posts, joists, rafters, floors, fittings.

Boat building: Masts, oars, poles, outriggers.

Utensils: Water tubes, furniture, cooking utensils, tools, weapons, use of bamboo in fisheries.

Full length specimens of bejuco (one of 400 feet) uses for construction, furniture, navigation, agriculture, forestry, and transportation.

Gums and resins.—Origin and process of manufacture to be very fully illustrated by transparencies and enlargements. Special emphasis to be laid on the wasteful results of present methods.

Gutta-percha. Map showing localities which produce gutta-percha, photographs and specimens of trees which produce it, processes and implements of collection in different regions, photographs to be supplemented by actual specimens wherever possible. Specimens of native product, showing impurity, Chinese adulterations, pure gutta, a 5,000-pound weight suspended by bar of gutta, flying rings, suspended chair for testing, etc.

Rubber: The same type of exhibit as for gutta-percha.

Fibers, barks, dyes, oils, fruits, and seeds.—Collections to show origin, extraction, use, value, and distribution.

APPENDIX F.

REPORT OF THE CHIEF OF THE MINING BUREAU.

DEPARTMENT OF THE INTERIOR,
OFFICE OF THE MINING BUREAU,
Manila, P. I., August 31, 1903.

SIR: I have the honor to present to you my report covering the period from August 23, 1902, to August 31, 1903, in compliance with your instructions.

On August 26, 1902, I left Manila, after four years of continuous work in the Philippines, for a vacation in the United States, returning to Manila and resuming my duties as chief of this bureau on January 26, 1903. During my absence the bureau was in charge of H. D. McCaskey, B. S., mining engineer for this bureau, as acting chief, and the work of the bureau was conducted with marked ability and with most satisfactory results. The work of the bureau during my absence is fully stated in the report of Mr. McCaskey, hereto attached, and to which especial attention is called. This report is so complete in itself, and so admirably sets forth the needs of the bureau, and the work that it has accomplished, that little more remains to be done on my part than to give it my indorsement and approve its recommendations, and this I do without reservation.

VACATION OF MINING ENGINEER.

On May 1, 1903, Mr. McCaskey took his departure for the United States for a well-earned leave of absence, and will return on October 1 and resume his duties. During his absence we have attempted to conduct the business of the office, including the work of the engineer, with the aid only of the temporary and occasional assistance of other departments of the government, and it was not possible to find a man with the necessary qualifications for temporary employment. In this connection I acknowledge the valuable aid of the bureau of government laboratories, and especially my indebtedness to Prof. Paul C. Freer, the superintendent of that bureau.

The absence of Mr. McCaskey has demonstrated in the most emphatic manner the necessity for the reorganization of this bureau and the augmenting of its force of skilled geologists, mineralogists, and engineers.

MINING INDUSTRY ESTABLISHED AND ITS GENERAL CONDITIONS.

During my incumbency of this office, dating from March 10, 1900, owing to the lack of a mining law, unsettled conditions during a large portion of the time, and the natural difficulties to be met with during

the period of inauguration and establishment of a civil government, in place of a military government, it has been the policy of this bureau to avoid expansion, and to devote its time to a thorough preparation of the work demanded for the establishment of the mining industry, when the favorable period for that work should arise. Immediately upon my return from my vacation, finding that the law enacted by the last Congress had been promulgated and was generally understood, and that the conditions under civil government had so improved, it was clear that an active campaign on the part of this bureau was more than justified, and the time fully arrived when the work so long contemplated for the successful planting and establishment of the mining industry should be undertaken. Conditions are no longer doubtful or problematical. The work of aiding, encouraging, and promoting the establishment of mines, which had been so long in preparation, and to a limited extent already inaugurated, was immediately undertaken, and with gratifying success. The island of Batan, forming a part of the provincial territory of Albay, and which had been spoken of as a "solid mass of coal" is to-day in process of rapid development with the Spanish corporation Minas de Carbon de Batan opening the rich mines called "Bilbao" and "Chifladura," on the east end of the island, at the headwaters of the Calanaga River, and with an electric railway in process of construction, connecting the mines with a deep-water harbor on Calanaga Bay; while at the same time Lieut. H. L. Wigmore, Corps of Engineers, U. S. Army, with a force of competent and skilled miners, under direction of the Secretary of War, is opening and developing the coal seams on the west of the same island, near the village of Linguan, and with a core-drill is carrying on a systematic examination of these deposits for the purpose of determining their extent and value.

The well-known gold deposits of Mambulao and Paracale, in Ambos Camarines, where large holdings under Spanish grants are owned by sundry claimants generally spoken of as the German syndicate and the English syndicate, and whose labors were interrupted by the revolutions of 1896 and 1898, have again acquired an active development. The properties of both organizations have again been occupied, the mines examined and reported upon by able experts from Europe and the United States, and it is understood that capital has now been secured, and that during the next year the stamps will be falling. With the addition of other companies formed and in process of formation, this well-known and rich auriferous region will be transformed into a bustling and prosperous mining camp. In the accomplishment of these results in Albay and the Camarines, this bureau has taken an active part, and the desirability of the inauguration of the work of encouraging, aiding, and promoting the mining industry along the lines followed by the State bureaus of mines in the United States has been clearly demonstrated. The work of locating mining claims under the new mining laws, and the prospecting and developing work done thereon in Surigao (island of Mindanao), Benguet, and Lepanto-Bontoc (island of Luzon), and many other localities in the Archipelago, with which are connected names that demonstrate the confidence of our best men in the mineral resources of the Archipelago, all point to an era of careful, conservative, and substantial progress. This bureau is especially gratified at the interest shown by the natives in the several mining localities and their efforts to investigate and develop the mineral deposits

in their several localities. In general terms, progress is thus indicated, and to this result the bureau has contributed in no small degree, many of these enterprises having been under consideration and report for more than two years.

STATUS OF RECORDS AND REORGANIZATION.

The difficulties connected with titles, and the absence of mining laws during the former years of American occupation, have presented almost insurmountable difficulties. The unclassified and heterogeneous mass of records and archives in this bureau, in the state in which they were received in March, 1900, added to the difficulties instead of proving an aid and assistance, as they should have done. They have hitherto proved a hindrance, since the partial reports have furnished a basis for publications which have not been well considered, resulting in the exaggerated importance of some localities that had been proven to be of little or no value upon subsequent examinations and reports, while other localities of known and established merit have been completely ignored. Last year this bureau was able to report the classification and arrangement of the contents of the many portfolios of documents, titles, and other papers, to which has since been added a chronological classification, taken from the record books of various kinds, and the two works have now been consolidated into one general chronological index, and the final and perfect transcript is now being transferred to permanent books, and at the date of this report has been brought down to the year 1893, and will be completed in a few weeks. In this work the chief of the bureau acknowledges and commends the work of Gabriel M. de Ubago, who has been with the bureau since its organization, and who has gained a knowledge and insight into this class of work that renders his services well-nigh invaluable. Gabriel M. de Ubago is a native of Manila and a young man. His work in this bureau clearly demonstrates the capability and adaptability of the people of the islands, when educated and trained, to become proficient in departments of labor requiring mental application and industry.

Out of these difficulties, and as a result of experimental work in field surveys and reconnoissances, and experiments in the promotion and encouragement of genuine and applied mining, has grown the proposition for reorganization now before the honorable Philippine Commission for consideration upon a minute and extended report of the chief of this bureau, made under the direction of the department of the interior and the special report of H. D. McCaskey, B. S., the plan for which is discussed in his report, hereto attached. This has been further supplemented by a voluminous report to the acting secretary of the interior, from this bureau, made since Mr. McCaskey's annual report was written, in which every practical detail is pointed out, showing the necessity for the reorganization recommended. These suggestions are practical, not purely theoretical, having been clearly demonstrated by experience. Actual, established, dividend-paying mines are needed. With proper encouragement it has been demonstrated that they can be established. I have asked and recommended that there be placed at the head of this bureau a mining engineer and geologist, and that he be provided with two able and efficient assistants, which will enable him to place in the field each year during the dry season three field parties

for geological and mineralogical reconnoissances, and that all remaining matters relating to titles be transferred to the bureau of public lands, where the titles to mineral lands, under the new law, are now located by virtue of the act of Congress, thus leaving this bureau for the geological and mineralogical studies just indicated and the systematic work of encouragement and promotion of the mining industry along the lines followed by the several State mining bureaus in the United States, but a work which is not accomplished or attempted by the Geological Survey of the United States.

In the first order for the reestablishment of this bureau, General Order 31, Office of the United States Military Governor, March 10, 1900, the question of titles and mining legislation was the most important work needing attention. My knowledge on these subjects, and my experience of many years in mining and mining regions of the United States, prompted my detail as a United States volunteer officer for the undertaking of this work. With the retirement of the military government and the successful establishment of the civil government, the inauguration of the logical reconnoissances and the establishment of successful mining operations, it would seem that the time had arrived for my retirement as chief of the bureau and the selection of a man who is at once a mining engineer and a graduate of a reputable school of mines, and I have so recommended, and again renew my recommendation. In retiring from the active direction of this bureau, in the work of which I feel the strongest interest, I desire to express my appreciation of the support I have received from the secretary of the interior and his associates on the United States Philippine Commission, and at the same time I urge upon them the necessity for the reorganization and thorough equipment of this bureau for carrying out the plans for the development of the mining industry, which it has been my pleasure, with the able and loyal assistance of H. D. McCaskey, as mining engineer, to inaugurate.

TEMPORARY REDUCTION OF EMPLOYEES.

The bureau has been able to dispense with the services of a translator, and that position has been vacant since September 1, 1902, resulting in a saving of \$900 per year. In this connection I respectfully call attention to the necessity of the American employees having or acquiring a knowledge of the Spanish language. In my judgment, such a knowledge is a condition almost prerequisite to the efficient discharge of duties in any capacity in the bureau, having to do with records entirely in the Spanish language, as is the case in this bureau. The native employees who have been with us one year and upward have all acquired a practical knowledge of the English language, with one exception. The near completion of the chronological index enabled the bureau to dispense with the services of the assistant record clerk on July 20, 1903. The proposed reorganization will require men of entirely different qualifications and an increased force of employees. The reduction of expenses for employees is therefore only temporary.

MINERALOGICAL MAPS.

The bureau has completed a map of the Archipelago showing the mines and mineral discoveries of the Archipelago, upon which the authenticated mines and proven mineral deposits of value are shown and

all deposits based upon rumor or insufficient proof have been omitted. The object and purpose of this map is to show known and proven deposits only, and does not purport to represent all mineral deposits in the Archipelago, regardless of the source or value of the information. The map has been furnished with an appropriate border, and is the work of the two native draftsmen of this office, Hugo Navarro and Justo Reynoso, and this portion of the map is from their own original designs. It is a work of art and reflects the greatest credit upon the native workmen who made it. The map will be sent to the St. Louis Exposition.

“MINAS DE CARBÓN DE BATAN.”

In April of this year an informal visit of inspection was made to the coal mines of this company on the island of Batan. A brief reference to these mines has been made; their importance demands a more extended notice. Notwithstanding the careful preliminary studies of the Calanaga coal deposits and the island of Batan, both from Spanish records and archives and the reports of our American engineers, who have visited this locality for the express purpose of investigating and reporting thereon, I was scarcely prepared for the combination of favorable circumstances exhibited at the mines of this company, where, on the occasion of my visit in April last, I found 20 Spanish miners from Bilbao, Spain, with a force of 50 natives and Chinese, actively engaged in opening up the deposit of coal of the “Bilbao” mine, and all under the direction of an expert and trained Spanish mining superintendent. The “Bilbao” mine is located on the Calanaga River, about $1\frac{1}{2}$ miles from the bay of the same name, where the company have erected storehouses and other buildings, and at the time of my visit were preparing to construct a wharf to enable them to load coal direct from the cars to the ships. The roadbed for an electric railway was being constructed, to connect the mines with the storehouses and the wharf. A short time after my return the truck cars, locomotives, and other machinery for the plant, all of modern style and first class in every respect, were received and shipped to the mines, where they are being installed. Seven tunnels had been started on the “Bilbao” at the time of my visit, all of which were only slightly advanced, but sufficiently to discover several veins of coal running parallel to each other with an approximate inclination of 20° and a width of 1 meter. These veins are from 3 to $3\frac{1}{2}$ meters apart, and the strata between them did not seem to contain any substance that was combustible. The roof of the galleries seemed to be very strong, and the abundance of timber on the claim itself and in the immediate vicinity insures a cheap and practically inexhaustible timber supply. The tunnels were not advanced sufficiently to enable us to give more specific descriptions of the coal deposits. The mine is so situated as to facilitate drainage, and a short distance from the mine are commodious and comfortable houses, erected by the company, for the shelter of a mining population of 200, and with cleared and improved ground permitting an extension to accommodate as many thousand. The Calanaga River and several fresh-water springs furnish an abundance of good water for domestic purposes. The system of mining adopted is what is known as the Japanese system, and arrangements have been made for the establishment of a village of 50 families of expert Japanese miners and their employment in these mines. A thriving native village has

sprung up on Calanaga Bay about the warehouse and office quarters of the company, composed almost entirely of the employees of the company and their families. The evidences of industry and the general air of prosperity, accompanied by skilled and practical mining work, under the direction of competent and experienced miners and superintendents, were all very gratifying indeed. A second and formal inspection of these mines will be made in the immediate future and a special report made thereon. The quality of the coal, judged from that which has been extracted up to date, is very good, and a survey of the coal area of the "Bilbao" and its adjacent holding indicates that it will sustain a production of 1,000 tons per day for a period of fifty years in case the veins shall prove continuous and develop according to local and outer appearances.

GOVERNMENT EXPERIMENTS.

A brief reference has been made to experiments now in progress and the development of the coal areas on the west of the island of Batan under the supervision of the War Department. This portion of the island of Batan has been withdrawn from settlement and mineral location under the provisions of the following executive order:

EXECUTIVE ORDER

No. 34.

GOVERNMENT OF THE PHILIPPINE ISLANDS,
EXECUTIVE BUREAU,
Manila, June 5, 1903.

Pursuant to the provisions of act No. 648, Philippine Commission, entitled "An act authorizing the civil governor to reserve for civil public purposes and from sale or settlement any part of the public domain not appropriated by law for special public purposes until otherwise directed by law, and extending the provisions of act No. 627 so that public lands desired to be reserved by the insular government for public purposes, or private lands desired to be purchased by the insular government for such purposes, may be brought under the operation of the land registration act," I hereby reserve and withdraw from sale, settlement, or private mining claims, for the purpose of governmental coal mining, all the public domain within the following description: All that part of the island of Batan west of the shortest straight line drawn from the center of the mouth of the creek which empties into the head of Caracaran Bay on the south side of the island, to the waters of Caba Bay on the north side of said island.

WM. H. TAFT, *Civil Governor.*
By A. W. FERGUSON, *Executive Secretary.*

Located within this area are the first-class Spanish mining grants "Balerna," "Urgera," and "Ganalda," owned by Villanueva & Co., and the "San Francisco," owned by Emilio Muñoz, both residents of the province of Albay, to which, for civil purposes, the island of Batan is attached. These mines were visited by the chief of this bureau in April last for the purpose of examining the markings and verifying the Spanish surveys and locations. This was the first official examination made by this bureau for the purpose of verifying Spanish mining surveys. Various reports have reached the bureau during former years that these so-called Spanish mining surveys had been made upon paper alone and that no markings or tracings of the survey work could be found upon the ground. However true these reports may be in other cases, as to which this bureau expresses no opinion whatever, they were found to be untrue in the case of the above-mentioned mines. Assisted by Lieut. Edward M. Markham, Corps of Engineers, U. S. Army, a thorough examination and verification was made with the necessary measurements and observations, and upon comparison

with the plats and field notes of the Spanish official survey, as contained in the records and archives of the mining bureau, not only were the original corners as located by the Spanish engineers found in place, with one or two exceptions due to natural decay or other local causes, but the exact location by reference to fixed and permanent monuments was found to be in every respect accurate. The owners had also fully complied with the act of Congress requiring restaking and remarking within six months from the date of the promulgation of the new mining law provided by Congress, supplementing the original survey corners and discovery posts of the Spanish engineers with new and substantial posts and carved and painted signboard markings. The result of this examination was reported to the commanding general of the division of the Philippines, at whose request the official inspection and verification had been made.

The Señores Villanueva and Muñoz, claimants of these mines, readily entered into a satisfactory arrangement by which the Government acquired the interest of these owners in their mining concessions under terms that were satisfactory to both parties, and the Government entered into the quiet and peaceable possession of these properties.

This class of experimental and development work can not be overvalued in importance. It had its inception in the report of this bureau on "The Coal Measures of the Philippines," submitted to Gen. Arthur MacArthur, military governor of the Philippines, by this bureau, on June 30, 1901, resulting in a thorough examination of the various coal deposits of the islands by direction of the Secretary of War, for the purpose of selecting a site to be used for experimental purposes in investigation of the extent and value of the coal area. Lieut. Edward M. Markham, Corps of Engineers, U. S. Army, was designated for this purpose, and, cooperating with and assisted by this bureau, he made a most thorough investigation and report with recommendation for acquiring the properties above-described.

For more than fifty years the home Government of Spain had been importuned to assist in the investigation of the coal areas of these islands and to promote their development, but with no better results than the multiplication of orders and decrees directing the insular government to encourage the coal mining industry, and exempting for a limited period coal and iron mines from special taxation. This work was and is of such a nature, owing to the peculiar conditions that prevail here, that the General Government should, at its own expense, undertake and conduct these extended investigations; investigations that are not practicable or reasonable to expect from private persons and corporations. It is with a sense of gratification, therefore, that I report this action on the part of the Government of the United States, marking, as it does, another and most important evidence of the interest felt by the United States in the future welfare and prosperity of these islands, and their population. The Philippine Islands have the coal; it is good steam coal; it ranks with the best qualities of Japanese coals; it is a source of great wealth; its importance to these islands is such that the continuance of the present labors and experiments should receive unqualified indorsement and support, as I have no doubt it will.

AMENDMENTS TO EXISTING MINING LAWS.

While the new law, enacted by Congress for the disposition of the mineral lands of these islands, places this matter in the charge of the insular bureau of public lands, I deem it proper to suggest that the provision allowing the location of but one claim upon a ledge or deposit by one person or corporation is, in my judgment, a mistake, and that the provision should be modified or entirely repealed.

CHARGES OF THE GOVERNMENT LABORATORY.

Since the preparation of the report of Mr. H. D. McCaskey, the mining engineer of this bureau, which accompanies this report, rules and regulations requiring the payment of fixed fees and charges for the work done by the bureau of government laboratories at the instance and request of other bureaus and departments of the government and for exclusively public uses have been so changed that such charges are no longer required and the remarks and recommendations made in Mr. McCaskey's report upon that subject are no longer applicable. They are allowed to stand, however, as a clear and concise statement of the relations that should and, which I am pleased to add, do exist between this bureau and the bureau of government laboratories. This bureau acknowledges its indebtedness to Dr. Paul C. Freer, the efficient and courteous superintendent of government laboratories.

THE ST. LOUIS EXPOSITION.

The exposition board having taken under its exclusive charge the preparation of the mining exhibit for the St. Louis Exposition, this bureau has been unable to add very much to the success of that portion of the Philippine's exhibit. The bureau has, however, cooperated with the exposition board in every way possible, the limited number of employees of this bureau and the absence of its mining engineer on a vacation of several months, being taken into consideration. We understand that the recommendations of this bureau, set forth in the report of the mining engineer, have been adopted and so far as possible executed by the exposition board.

BULLETIN NO. 3.

This bulletin, referred to in the report of Mr. McCaskey, entitled, "Report on a Geological Reconnaissance of the Iron Region of Angat, Bulacan," has come from the press of the public printer, is now being distributed, and meets with such demand that the edition of 1,500 copies will soon be exhausted. Its illustrations, plates, and tables, all of which are the work of the public printer, are of first quality, and it is believed that this bulletin will result in the establishment of the iron-mining industry in Bulacan upon a much more extended scale than that at present in vogue among the natives. The demand for a similar survey and reconnaissance, with the publication of bulletins thereon, for the Camarines, Lepanto-Bontoc, Benguet, and the island of Masbate is urgent, and the United States Philippine Commission has been requested to provide this bureau with the necessary corps of employees to enable this work to be done during the coming dry season. I strongly recommend this increase, and for the purposes named.

PROGRESS OF THE YEAR.

While the number of prospectors has been greatly diminished during last year, the real and substantial progress of the mining industry and the developments, and locations, and the new discoveries far exceed that of any previous year, and the general outlook for activity and success in the mining industry is exceedingly favorable.

YEARLY EXPENSES.

A tabulated statement of the expenses of this bureau for the fiscal year 1903 accompanies this report as Exhibit A.

RECOMMENDATIONS.

In addition to my indorsement of the recommendations of Mr. H. D. McCaskey, as mining engineer and acting chief from August 26, 1902, to January 26, 1903, I respectfully recommend:

1. The amendment of the present mining law so as to enable more than one claim to be located by the same individual, or association of individuals, upon each load or deposit.

2. The immediate provision for the field work necessary to enable this bureau, during the coming dry season, to procure the material for the preparation and publication of a bulletin on each of the prominent gold-bearing districts of this archipelago, viz: Camarines Norte, Lepanto-Bontoc, and Benguet, and the island of Masbate.

3. The enactment of laws for policing and sanitation of mines.

4. The free use of timber required in mining, subject to reasonable regulations and restrictions to prevent waste.

Respectfully submitted.

CHARLES H. BURRILL,
Chief of the Mining Bureau.

The SECRETARY OF THE INTERIOR,
Manila, P. I.

EXHIBIT A.

Expenses of the mining bureau for the fiscal year ending June 30, 1903.

	Allowed.	Expended.	Balances.
First quarter:			
Salaries	\$2,400.00	\$2,316.66	\$83.34
Transportation	150.00	58.80	91.20
Geological and mineralogical surveys	1,264.29	-----	1,264.29
Contingent expenses	688.55	421.52	267.03
Printing and binding	250.00	250.00	-----
Reimbursements	14.00	14.00	-----
Second quarter:			
Salaries	2,400.00	1,938.33	461.67
Geological and mineralogical surveys	100.00	49.50	50.50
Contingent expenses	248.48	74.85	173.63
Printing and binding	1,055.00	575.50	479.50
Third and fourth quarters:			
Salaries	4,800.00	4,038.32	761.68
Contingent expenses	287.10	110.37	176.73
Printing and binding	946.40	9.10	937.30
Total	14,603.82	9,856.95	4,746.87

Estimated liabilities.

Salary retained.....	\$75. 00
Contingent expenses, goods in transit	150. 83
Printing and binding (bill rendered since June 30, 1903).....	1, 005. 80
Total	1, 231. 63

Corrected balances.

Allowed	\$14, 603. 82
Expended	11, 088. 58
Unexpended balance	3, 515. 24

REPORT OF THE MINING ENGINEER.

OFFICE OF THE MINING ENGINEER,
THE MINING BUREAU,
Manila, April 30, 1903.

SIR: In contemplation of my departure from Manila on May 1, upon accrued leave of absence, after continuous service as mining engineer for the mining bureau for nearly three years, I have the honor to submit the present report and recommendations for the period extending from August 27, 1902, the date of my last annual report, to the present time.

OFFICE WORK.

By far the greater part of the time during the eight months included in this report was given to office work. For the first five months of this period, during the absence on leave in the United States of the chief of the bureau, the undersigned served as acting chief of the bureau, upon recommendation of the chief and appointment by the secretary of the interior.

The act of Congress of the United States, No. 235, was proclaimed in force in the Philippine Islands by the vice-governor on August 14, 1902, or about two weeks before the undersigned assumed charge. A large portion of this act, constituting the present mining law for the islands, an important feature of the correspondence of the bureau immediately became that upon the subject of the law. This act was but imperfectly understood by many for some months, and letters frequently came to the bureau requesting interpretations of the law and applications of it to individual cases. Among important questions that were raised were: (1) A determination of procedure in case minerals were found upon lands yet under military jurisdiction, in which there were no civil officers who might act as mining recorders; (2) the lack of uniformity in procedure, as reported by prospectors, among provincial secretaries acting as mining recorders under the law; (3) the failure of the law to provide whether mineral deposits valuable for fertilizers, building stone, brick or other clay, etc., should be classed with placer claims for purposes of obtaining title to land; (4) whether enlisted men in the Army of the United States might locate and record claims; and others. These letters were referred, personally or by indorsement, to the consideration of the chief of the bureau of public lands as, under the law, this officer is now charged with the administration of mineral as well as of other lands. In some cases conferences were had between the chief of the bureau of public lands and the acting chief of the mining bureau, as results of which the questions involved were brought to the attention of the secretary of the interior. Upon some of these questions interpretations of the law were requested from the attorney-general, some of which interpretations are in the files of the bureau. In no case did the acting chief feel that his position was more than that of an intermediary indorsing officer, to whom much of the correspondence was directed only because the provisions for the administration of the mining law were not better understood. The position was obviously a difficult one, particularly as some of the questions came by telegram and sufficient delays for the indorsement and reference of these messages to the proper officers were inevitable.

The chief of the bureau of public lands having been directed by the secretary of the interior to report a bill prescribing regulations for locating and recording mining claims, the acting chief of the mining bureau was also directed to make such suggestions in these matters as he thought proper. As a result of this opportunity,

under authority granted in act 235 to the Philippine Commission by the Congress of the United States, a bill was submitted to the secretary of the interior which was subsequently enacted by the Commission as act 624, and which provides not only forms and procedures for locating and recording claims, but which also provides (Sec. 1) that * * * "a placer claim shall be understood to mean a claim of land more valuable for placer mining, stone quarrying, or for the securing of earth for use in tile, brick, pottery, paint, or other manufacture, or of petroleum, guano, or other mineral product, than for other purposes * * *." The act also includes section 16, also submitted by this bureau, in which the important subject of what may be included in assessment work is provided for.

The correspondence files of the bureau relating to the above, to the information division, and to the various other lines of work upon which the mining bureau has entered, show that for the five months during which the undersigned was in charge 368 letters were received and 413 letters were sent, all forming part of the records of the office.

During this period the material for Bulletin No. 2, "A Complete List of Spanish Mining Claims Recorded in the Mining Bureau," which was prepared by the chief of the bureau before his departure, was copied, compared, and sent to the public printer. The proof was read and returned, and the issue of 1,500 copies was received shortly after the return of the chief.

In this connection I would recommend that, as the number of requests for Spanish translations of the bulletins of the bureau is constantly increasing, the vacant position in the office force of translator be filled by a competent man at an early date, and that steps be taken for an issue of 1,000 copies of each of Bulletins Nos. 1, 2, and 3 in the Spanish language. That this would greatly increase the purpose and usefulness of the work I have no doubt.

In addition to the work as acting chief of the mining bureau the undersigned performed his own duties as mining engineer. Among the letters received and sent as above given and since the return of the chief were many relating to the mineral resources, to maps, to matters of geology, mineralogy, and mining, and to determinations in the office of samples sent to the bureau for investigation and report.

THE MUSEUM.

Constant additions to the geological and mineralogical museums are being made. During the past year many samples of rocks, soils, and minerals have been given to the bureau by mining and business men, by officers and enlisted men of the Army and constabulary forces, and by insular and provincial officials. The list of donors is too long to be given in this report, but to them the appreciation of the bureau is here expressed. These samples from the Philippines, from the United States, and from other countries are of great educational value to visitors, and they materially assist our knowledge of the geological formations of the archipelago.

During the field trips of the undersigned to the Calamianes, Cuyos, and Paragua groups of islands, and to the coral island of Apo, a suite of about 120 representative samples was obtained and added to the museum.

The building now occupied by the bureau is furnished with comfortable offices, but is very unsatisfactory in its fitting for the museums. The cases of specimens are necessarily crowded together, for lack of space, and the light is very poor. For this reason no expense has been incurred during the year in the repair of the cases, which are also in a most unsatisfactory condition, and the collections have received rather less time and attention than they actually deserve. It is hoped that a wing of the new building for the bureau of government laboratories may be provided at an early date for the proper home of the mining bureau, and that in this ample room may be had for the constantly growing museum.

The collections of the bureau are not to be understood as taking the place, in any sense, of similar collections in the permanent museum of the islands nor in the mineral exhibit of the Philippines at the St. Louis Exposition. These are working collections and are of constant use in the bureau in the comparison and classification of specimens, and in the study of the geology and of the mineral resources of the Philippines. These collections shown to visitors, with competent explanation, have also a great educational value, much greater perhaps than more expensive collections of a larger museum could have, when viewed without competent personal guidance and instruction.

It is hoped that during the present summer advantage may be taken by the mining engineer of his leave of absence in the United States to the extent that a series of typical geological, metallurgical, mineralogical, and paleontological collections may be secured for the important features of bureau work outlined above. That the initial cost of these collections will ultimately prove small in comparison with the benefits to be derived therefrom it seems almost unnecessary to state.

LABORATORY WORK.

The author of this report, as mining engineer for the mining bureau, has identified and classified many specimens sent in to the bureau, but the basis for determination has been largely by microscopic and blowpipe analysis and in the great majority of cases, in competent hands, these determinations suffice. Where analytical chemical work has been required upon a more extensive scale before the classification of the specimens in hand, the samples have been referred to the bureau of government laboratories for quantitative determination of the elements and substances required, for the reason that the many other duties of the engineer prevented him from performing this work himself. This quantitative work, done largely by Mr. Paul L. Stangl and P. J. Fox, under the direct supervision of Dr. Paul C. Freer, superintendent of government laboratories, and of Dr. P. L. Sherman, investigator and analyst, has been most prompt and satisfactory.

In a recent circular issued by the superintendent of government laboratories a scale of charges is announced for all future work of this kind, whether done for private parties or for the good of the government service. As the future work of the mining bureau will probably be more upon scientific lines than before, and as a large amount of analytical work will be required, which, by the express intention of the act providing for the government laboratories, should be performed in said laboratories, it is hoped that an arrangement may be made, perhaps semiannually in advance, between the chiefs of the various bureaus requiring this analytical work and the superintendent of government laboratories, whereby such work for the purposes given may be performed free of charge. This suggestion is based on the idea that in the insular government the free interchange of service is at present almost uniform and has not only the advantage of avoiding much labor, clerical and administrative, in the preparation of vouchers and transfer of funds, but has the far more important advantage of keeping at a minimum the amounts required by the various bureaus in the appropriations of funds by the Commission and therefore of keeping at a maximum the amount of money in the treasury available for appropriation for other purposes, for it seems evident that the present plan of the superintendent of government laboratories will require a double appropriation for every analysis performed—i. e., an appropriation to the credit of the laboratories for the expense of the analysis and an equal appropriation to the credit of the bureau requesting the analysis for reimbursement of the laboratories for performing the work. Thus it would seem that double the amount required to pay for the work would be appropriated, and therefore not available for use by the Commission for other purposes, although the actual and ultimate cost to the government would be but half the sum so appropriated.

During the past few months, at the request of the superintendent of government laboratories, the assay rooms, material, and furnaces of this bureau have been placed at the disposal of an assayer designated by the superintendent to perform work which could not be done for lack of space in the buildings now occupied by the laboratories. The arrangement is not entirely satisfactory to either bureau, but it is merely temporary, and as such it seems to serve the purpose fairly well. It would seem advisable to transfer the laboratory material of this bureau, with the exception of such blowpipe and other apparatus as the mining engineer would find of use in his work, to the bureau of government laboratories, and to arrange in return for such assay and analytical work, free of cost, by the laboratories for this bureau as the scientific work of the mining bureau may from time to time require.

FIELD WORK.

During the past eight months the time of the mining engineer has been so largely taken up by his duties as acting chief of the bureau that opportunity has not been given for the amount of field work planned. An extended survey of the mineral regions of Benguet, Lepanto, and Bontoc, and other field work, had been provided for, but it was found necessary to postpone the work until some future time.

The bureau is furnished with but one engineer and he in turn is furnished with no scientific assistance whatever. As a result of this organization, the time of the engineer is necessarily divided between field, office, laboratory, and museum work, and in addition to these demands he has been for five months, as above stated, the acting chief. A plan is proposed for the now urgent reorganization and enlargement of the bureau, so as to render possible more extended scientific research, and this subject will be taken up in another part of this report.

Opportunity presented itself for rapid preliminary field work in the Calamianes, Cuyos, and Paragua groups of islands, and the undersigned was for six weeks, in all,

upon exploratory work as a member of an expedition to the Calamianes and Cuyos islands, under the Hon. D. C. Worcester, secretary of the interior, in December, 1902, and of another expedition to the islands of the Calamianes, Paragua, and Balabac, under Dr. Paul C. Freer, superintendent of government laboratories, in February and March, 1903. These islands are of particular interest geologically because of their location, and they have been but little studied and explored. It is believed that some valuable information has been obtained as a result of the brief season of field work, and that plans may be better outlined hereafter for further work in the islands visited. A separate preliminary report upon the Islands of Apo and of the Calamianes, Cuyos, and Paragua Groups has been prepared and is herewith respectfully submitted.

MINERAL EXHIBIT AT THE ST. LOUIS EXPOSITION.

By direction of the honorable the secretary of the interior, the undersigned, while acting chief of the bureau, prepared and submitted an outline plan for an exhibit of the mineral resources of the Philippines for the Universal Exhibition at St. Louis in 1904. This plan, as approved by the honorable the secretary of the interior, and adopted after conference between the honorable the secretary of the interior, the member in charge of the exposition board, and the acting chief of the mining bureau, is as follows:

(1) *Geological*.—A representative suit of geological specimens. Island of Panay, 350 pieces in two double cases. Representative fossils of the Philippines, including samples of silicified wood.

(2) *Mineralogical*.—Representative minerals of the Philippines, including economic mineral products (coals, sulphur, limestone, gypsum, petroleum, kaolin, asbestos, fossil copal, etc., and ores of metals). Small samples.

(3) *Mining and quarrying*.—Representative ore samples from the mines of the Philippines, larger size than (2), with gangue and country rock exhibited, including gold, copper, lead, iron, mercury, coals, and sulphur. Representative samples of building stones in the rough, and polished. Road metal, etc.

(4) *Industrial*.—Representative exhibit of native tools and implements in mining and metallurgy. Igorrote bateas, pans, picks, ore baskets, models of Bulacan furnaces, smelter-camarin, and furnace accessories. Representative exhibit of Filipino mine and metal workers. Igorrotes of Lepanto-Bontoc, Tagalos of Bulacan, etc., showing native methods.

(5) *Illustrative*.—Maps and plans of mining regions, mines, and improvements. Photographs, enlarged and framed. Illustrated reports on mines and geological areas. Bulletins and other publications of the mining bureau, including edited translations. Sketches and diagrams of machines and metallurgical processes. Plaster casts of volcanoes.

NOTES.—(1) Two collectors, intelligent miners who have been in the mining districts of the islands for a year or more and understand the routes of travel, native characteristics, and practical means of economy, to be appointed at a reasonable monthly wage and expenses, to make the collections under proper supervision, with native assistants where necessary. (2) Implements, models, etc., to be made by natives only wherever possible, and of native materials, and every piece so made to be so marked. Cases for mineral specimens to be of Philippine woods, if possible. (3) Large oil paintings and drawings by native artists to be obtained, if possible, to pictorially illustrate in color Igorrote miners and smelters at work in the mountains of Lepanto and Benguet, Tagalo iron smelter men in Bulacan, and gold washers at work in the Camarines or Mindanao, to show native methods, tools, etc., with background of typical scenery of Philippine mining camps.

This plan for a mineral exhibit has been adopted by the exposition board, and as that board has been appointed and provided by the Commission, with all funds for the purpose, the work is being carried to completion largely by them. Two thoroughly capable collectors, Messrs. Albert P. Wright and Valentin Wilson, were recommended by the acting chief of the mining bureau and appointed by the member in charge, and they have entered enthusiastically and ably upon their work. Their first itineraries having been arranged upon consultation with the bureau, Mr. Wright has canvassed the provinces of Benguet and Lepanto-Bontoc, and Mr. Wilson has covered the important field of the Camarines. At the time of writing this report both of the collectors have returned to Manila with large and important collections of samples upon the plans outlined, and are now preparing for further work.

As an exhibit, first for the permanent museum which was opened in Manila on February 23 by the Hon. William H. Taft, governor of the Philippine Islands, and

later for the Philippine exhibit at St. Louis, the mining bureau has contributed geological and mineralogical collections, plaster casts of the volcanoes of Taal and Mayon, and samples of native workers' implements. Further contributions contemplated are maps, plans, publications, and such further collections as may be obtained.

BULLETIN NO. 3.

The publication of Bulletin No. 3, A Geological Reconnaissance of the Iron Region of Angat, written by the undersigned after a period of investigation and fieldwork in Bulacan in the early part of 1902, was contemplated in the latter part of the year. Owing to misunderstanding concerning the funds available for this purpose, however, the issue has been delayed. This postponement has served the purpose of enabling the bureau to include in the report a larger number of analyses than could first be hoped for; therefore a good end has been served by a delay that has otherwise been a matter of great regret.

The manuscript of this bulletin was prepared for the public printer during the past three months and the publication is now in press. An early issue of 1,500 copies, with maps, sketches, photographs, and tables of analyses is expected, and it is hoped that this bulletin will present in a satisfactory manner the desired information upon the most important iron district now known in the Philippines, and upon the highly interesting methods of native smelting and metallurgy.

REORGANIZATION OF THE MINING BUREAU.

By direction of the chief of the bureau the author of this report has prepared and submitted during the past month the draft of a comprehensive act for the reorganization of the mining bureau along the lines of the most successful mining bureaus of the United States, together with a special report accompanying the same. As this matter is rather fully treated in the report mentioned, no further comment seems important at this time beyond calling attention to the urgent need for such reorganization at the earliest practicable moment.

The scientific, statistical, technological, and economic work of the bureau has been seriously handicapped during the past two years by an inadequate force with which to do the work. Great opportunities lie before the bureau in the study of the mineral resources of the islands and in the placing before the public in the form of reports and bulletins the results of such work, to the end that capital may have reliable and official information upon which to base investment and that the mineral wealth known to exist in these islands may be properly and economically developed.

The draft of the proposed act contemplates such recognition of these possibilities as to enable this important work to be carried rapidly forward without further delay. It is strongly urged that the individuality of the bureau be maintained, with reorganization such as is planned in the draft submitted, and that means be provided for the full completion of the work so long contemplated by the chief of the bureau and by the undersigned.

Field and other work along the lines indicated has indeed already been begun. Only a single engineer, with no proper assistance and with many and varied duties, has been able to make but a beginning. It is sincerely urged that the work proposed for the future may be upon the broad, liberal lines planned, and that the bureau may assume its important and proper place in the scientific researches of the natural resources of the Philippines.

An immediate need of reorganization lies in the assistance that should be given at this time to the exposition board. The lack of proper information concerning the various features of mining, metallurgy, geology, and the mineral resources of the islands that now unfortunately to a large extent exists, and again to the impetus and encouragement that a well-organized and equipped mining bureau can constantly give to industries so important to the welfare of the people at large, would seem to justify such reorganization.

REPORTS.

In addition to the Special Report upon a Draft for the Reorganization of the Mining Bureau, and the Preliminary Report upon the Calamianes, Cuyos, and Paragua Groups of Islands, forming part of the work of the mining engineer for the present year, a number of minor reports have been made, copies of which are in the letter files of the office of the bureau, upon questions of geology, mineralogy, mining, and mineral resources of the Philippines and submitted to correspondents of the

bureau, and a large number of oral reports have been rendered to the chief of the bureau and to visitors who have called and requested information upon the subjects named. The work has been that of a consulting mining engineer in many cases. The aim has constantly been to render every possible official and professional assistance to the legitimate development of the mineral resources of the islands to all who apply, and absolutely free of cost. It is hoped that this important branch of the work may be continued and increased until consulting engineers open offices in Manila for private practice, after which time it may not be thought advisable for government engineers to deprive these men of their proper professional fees, and to this extent the assistance of the engineer of the bureau may then, perhaps, be much more narrowly confined.

THE NATIONAL ACADEMY OF SCIENCES.

In connection with the proposal of the National Academy of Sciences to undertake "Scientific surveys of the Philippine Islands," as outlined in a report of their committee to the President of the United States and submitted through Mr. Gifford Pinchot, of the Forestry Bureau, Washington, D. C., to the honorable the civil governor of these islands, the author of this report would most cordially welcome, in the broad scientific spirit in which the proposal is made, the great assistance that must come from such cooperation by the learned gentlemen of the academy in our research work in the Philippine Islands. In the domain of geology and mineral resources there is a vast and difficult field ahead; and the mining bureau, as organized under the proposed act, would earnestly join with such geologists as might be designated by the academy for work in this common field. The organization of the bureau on the one hand, and of the academy council on the other, should be clearly distinct; and it seems highly important that the two organizations should not only be cooperative during the tour of the Federal scientists in the Philippines, but should, in all fairness and to the best interests of the insular and national representatives alike, be coordinate in authority, council, and privilege. There is work for both organizations, and more of it than either can do for many years. It would seem most fortunate for the rapid progress of this work in the islands that a hearty cooperation and sympathy may exist, and that by a division of labor and by mutual aid this work may be rapidly and thoroughly entered upon.

Among the proposed lines of work presented by the National Academy it would seem that the most important during the present and immediate future is the plan for a systematic topographic and hydrographic survey. That this work can best be performed by the skilled topographers and hydrographers of the national Geological and Coast and Geodetic Surveys, respectively, there seems no room for reasonable doubt. Surveys under these organizations should be begun at the earliest date, in the opinion of the undersigned, and should progress as rapidly as conditions permit. There seems no other offering of the National Academy so important as this, and the acceptance of this is strongly urged.

It would seem necessary, before the insular bureaus can more fully report and advise, that the report of the committee of the National Academy be furnished in greater detail, and that the work proposed be much more fully outlined; and it is respectfully suggested that request be made for further information concerning such details of the plan proposed.

RECOMMENDATIONS.

In concluding this report I have the honor to recommend:

1. That Spanish translations of Bulletins Nos. 1, 2, and 3, and of future bulletins of the bureau, be prepared and issued for general distribution.
2. That provision be made for a suitable wing of the new building for the government laboratories, to be set aside and properly furnished and equipped for the use of the mining bureau.
3. That an early transfer be made to the bureau of government laboratories of all laboratory material now upon the property returns of this bureau, with the exception of such blowpipe and other apparatus and material as the mining engineer requires in his work.
4. That hereafter the bureau of government laboratories shall perform for the mining bureau, free of cost, such analytical and chemical work as may be agreed upon in advance by the chiefs of the respective bureaus.
5. That the mining bureau be reorganized at the earliest practicable time upon the basis outlined in the special report upon this subject submitted with the draft of an act for this purpose.

6. That the proposal of the National Academy of Science to enter upon "Scientific surveys of the Philippines" be cordially welcomed; that the plan to execute coast and geodetic and topographical surveys be accepted with the provision that the insular government may be furnished with copies of the reports and maps made at cost price; that the committee of the academy be requested to furnish further details of the work proposed along other lines; and that, should their proposals be accepted in full, it be upon a basis not only of cooperation but of coordinate authority and privilege between the proposed "Philippine council" and a similar council to be formed among the chiefs of the insular scientific bureaus concerned.

Very respectfully,

H. D. McCaskey,

Mining Engineer for the Mining Bureau.

CHAS. H. BURRITT,

Chief of Mining Bureau, Manila, P. I.

APPENDIX G.

SECOND ANNUAL REPORT OF THE SUPERINTENDENT OF GOVERNMENT LABORATORIES.

DEPARTMENT OF THE INTERIOR,
BUREAU OF GOVERNMENT LABORATORIES,
Manila, September 14, 1903.

BUILDING AND CONSTRUCTION.

In the report of the superintendent of government laboratories for the year ending August 31, 1902, the organization of the laboratory force and the beginning of work in the temporary quarters was described.

The detailed plans of the new laboratory building were practically completed at that time, but the site for the structure was not selected. The original intention had been to locate at Santa Mesa on the highlands just inside the city limits and near Sampaloc Cemetery, where a plot of ground had been kindly offered as a gift for this purpose by the Hon. Benito Legarda. However, in attempting to carry out this idea, considerable delay was experienced by the donor in arranging a satisfactory adjustment with other owners of the estate of which the proposed site was a portion, and consequently, so as to shorten the time during which the bureau would be compelled to do unsatisfactory work in the cramped quarters leased by it on Calle Iris, it was decided to look elsewhere for an available location; with the full knowledge that in the future the generous offer of Señor Legarda would be repeated for other government institutions equally important to the intellectual advancement of the islands.

After canvassing the ground thoroughly the Hon. Dean C. Worcester, secretary of the interior, the Hon. Bernard Moses, secretary of public instruction, and the superintendent of government laboratories selected a portion of the so-called exposition grounds, the intention being to have the laboratory building front on Calle Herran and occupy ground to the east of the driveway. This necessitated the purchase of a plot owned by the church which, if not acquired by the government, would make the entire piece of land irregular in shape. This land was bought, so that 26½ acres are now included in the exposition grounds.

The new building was begun in October, 1902, according to the original plans. The foundations of concrete have been pushed as rapidly as possible; at the present time they are completed and the framing of the superstructure is well under way. It is to be hoped, with the present rate of progress, the government laboratories will occupy their future quarters in April, 1904, and will then be able to extend

the courtesies of the institution to visiting scientists. Requisitions for the necessary power, boilers, pumps, and other mechanical appliances, as well as for the refrigerating plant, are now being completed, and probably all materials will be on hand to install the machinery by that time.

In the last annual report the cramped nature of the temporary quarters on Calle Iris was mentioned, but since then work has increased so rapidly that the superintendent of government laboratories found himself compelled to rent an auxiliary building on Calle Alix. The library of the bureau and the biological laboratory have been transferred to this additional space, which also gives opportunity for the storage of apparatus and supplies ordered for the new building, when an increased force of scientific workers will be available. Contrary to expectation, much of this apparatus is already needed in the present quarters, but certain pieces will remain unused until the final move is made. The requisitions were planned to include in the first shipment only such pieces of apparatus as could actually be used under present conditions, so the remainder of the supplies will probably not arrive until very shortly before the completion of the new building.

SERUM LABORATORY.

The serum laboratory, at the time of its transfer from the board of health to the bureau of government laboratories, was provided with accommodations sufficient only for about 10 vaccine calves, 15 or 20 serum cattle, and 5 or 6 horses. The demand for vaccine and rinderpest serum increased very rapidly during the last half of present fiscal year, because of the prevalence of smallpox and the beginning of the work of inoculating animals in the provinces, and in order to meet this demand the number of animals in the serum herd was increased as rapidly as possible. This necessitated the building of a quarantine station holding 40 animals in a separate portion of the San Lazaro estate, the construction of stalls in the neighborhood of the operating room, and the building of a feed barn and stables for about 200 animals. The rapid completion of these improvements was necessary in order to meet the extraordinary demand for space which would be made as soon as importations for the government from other countries would begin.

The present location was divided into three paddocks by fencing, enabling the separation of different classes of animals, and sidewalks connecting the most important buildings were added. A small laboratory for the scientific work relating to vaccine and serums was fitted up, and an operating room for the aseptic preparation of vaccine also was built. The necessity for investigating surra led to the protection of the horse stable by fly screens in such a manner as to render the spread of the disease from afflicted animals kept for purposes of study impossible, and the increased use of small animals, such as guinea pigs and rabbits, was the cause for the construction of proper quarters for this class of experimental material.

All of the structures which have been placed upon the present land have been temporary in their nature, for the reason that the portion of the San Lazaro estate occupied by the serum laboratory has been needed by the board of health for its own buildings, and because the placing of such a large number of animals in close proximity to a hos-

pital was undesirable. The superintendent of government laboratories therefore made an effort to secure sufficient land in another part of the city and nearer to the new laboratories on Calle Herran. By agreement with the municipal board a site in Paco became available, and when the laboratory is completed at that point the location at San Lazaro will be abandoned. This plan is in every way desirable, as it will furnish the serum laboratory with a permanent location for its animals free from the objection of the proximity to hospital buildings and with the added advantage of convenience in the administration from the main laboratory.

The land in Paco is fairly high, and according to levels will probably not be flooded excepting during the severest rains, which might occur once or twice in the rainy season. During the remaining time it can be drained into an estero lying about 1,500 feet to the north. On this spot it is proposed to construct permanent buildings for the manufacture of rinderpest serum. These will probably consist of four stables for cattle, built with cement floors and metal stalls, so as to render disinfection certain and positive, an operating room for bleeding cattle, a barn for feed and supplies, and a building for the watchman. The latter will also contain sufficient laboratory space to permit of caring for the fresh blood. The preparation of the serum, packing and shipping, will take place at the main laboratory. A quarantine stable for the purpose of observing animals before they are admitted to the serum laboratory will be built at the farthest corner of the land. A photograph of the proposed type of stable is given in fig. 4.

When the permanent site is completed, the laboratory can with certainty care for its animals in a most approved way, and will be able to avoid contagious diseases among them. The drainage problem is the most difficult one, but probably can be solved by disposing of liquid sewage through a septic tank and sewer to the estero, and by collecting solid manure in proper receptacles and permitting the use of the same in certain areas of land where cattle never graze and where all animals used are immune against rinderpest. This would be feasible in the farms occupied by the agricultural bureau. The argument against using manure from serum stables will disappear in the same degree as animals present in Manila and its surroundings are immune against rinderpest.

All vaccine work and the preparation of all serums involving the use of horses or small animals only will be conducted at the main laboratory building.

LIBRARY.

Since the last annual report the purchase of books contemplated by the Commission for the permanent equipment of the scientific institutions connected with the bureau and for the reference library has continued as funds became available. The care of this material at first was so slight that it could devolve upon the stenographers and property clerk of the bureau, but in the first quarter of the present year the necessity of adequate cataloguing, accession books, and of the proper care of the library, as well as of a system by which books could be taken out by laboratory workers, became apparent, and Miss Mary Polk was appointed librarian after an examination by the civil-service board.

The buying of sets of periodicals has necessarily been somewhat retarded, owing to the distance from the source of supply and the difficulty experienced by dealers in obtaining complete lists.

The chief publications which are now on hand and complete comprise Liebig's *Annalen der Chemie*, *Berichte der deutschen chemischen Gesellschaft*, *Berliner klinische Wochenschrift*, *Centralblatt f. Bakteriologie* (all parts), *Centralblatt f. die med. Wissenschaften*, *Centralblatt f. klinische Medicin*, *Centralblatt f. innere Medicin*, *American Medicine*, *Anatomischer Anzeiger*, *Baumgarten's Jahresbericht*, *Beiträge zur pathologischen Anatomie und zur allgemeinen Pathologie*, *British Medical Journal*, *Bibliographia Medica*, *Chemical News*, *Zeitschrift f. angewandte Chemie*, *Zeitschrift f. klinische Medicin*, *Zeitschrift wissenschaftliche Mikroskopie*, *Schmidt's Jahrbücher*, *Medical Review*, *Journal of the Chemical Society*, *Journal of the Royal Microscopical Society*, *Lancet*, *Hope-Seyler's Zeitschrift f. physiologische Chemie*, *American Chemical Journal*, and all of the Johns Hopkins publications relating to medicine.

The subscriptions cover the foreign scientific and medical periodicals, and have been taken for the current year since the inauguration of the laboratory, the complete sets of the important journals being filled in subsequently. There are a number of important sets which have been ordered and are now on the way. Only a few of these can be mentioned. They are, for example, *The American Journal of Medical Sciences*, *Poggendorf Annalen d. Physik u. Chemie*, *Annales de l'Institut Pasteur*, *Archiv der Pharmacie*, *Deutsche medicinsche Wochenschrift*, and the chief journals covering agricultural chemistry, chemical technology, anatomy, physiology, veterinary medicine, and certain portions of botany and entomology.

The necessity for periodicals covering the field of industrial chemistry has been apparent from the beginning, because many questions concerning manufacturing processes are continually submitted to the laboratories, and the chemical bulletins which it is proposed to issue will cover, if the greatest advantage to the islands is to be considered, the fields where new manufactures and improvements in the present industries can be made.

Adequate literature on veterinary medicine is needed, because the laboratories have constantly under their control from at least 100 to 125 animals, and because owners of cattle and horses are continually applying to the institution for advice. The most important sets of veterinary journals are either ordered or scheduled for the near future.

The beginning of the botanical laboratory furnishes the necessity for literature in the direction of its work. The benefits to be derived from accurate botanical investigations can be compared with similar ones to be undertaken for the purpose of advancing the chemical industries.

The biological laboratory in its work covers the ground of medicine and pathology, and the general scope of the bureau necessitates continual reference to chemical, pharmacological, pharmaceutical, toxicological, and physical literature. The library is intended to be one of maximum usefulness in scientific work, and is accessible to all persons who feel the need of referring to this class of books. In the building on Calle Alix it is shelved in a room sufficiently large to allow of its liberal use and is much more conveniently located than it formerly was on Calle Iris. A card system of cataloguing has been begun and

will be completed as fast as possible. The list of actual sets on hand and of subscriptions will be given in the report of the librarian.

In the future it is hoped this library will be used by educational institutions established in the Philippine Islands and will furnish the means of acquainting the Philippine workers with modern scientific advances. The need of adequately acquainting students who are natives of the Philippine Islands with modern medical and scientific work is great, and in conjunction with a medical school this library will form the greatest incentive to the advance of medical education in the islands.

An increasing number of Philippine students are now being educated in the United States, and it would indeed be a misfortune if upon their return to their native country they should be cut off from the literature which is most important in continuing their mental growth.

APPARATUS AND SUPPLIES.

The purchase of apparatus and supplies necessary for adequate work has greatly improved the condition of the laboratories during the past year. At the time of the last annual report the bureau was very much hampered by its inability to meet a great many emergencies which it encountered, and by the fact that many makeshifts of an inadequate nature were of necessity resorted to in adjusting itself to the conditions which surrounded it. Appropriations for apparatus and supplies were made early in the career of the institution, and the orders placed in Europe and America have been gradually filled, so that the workers may be said to be fairly well equipped at the present time, although many fields of work must still remain untouched. It was at first supposed that a considerable proportion of the mechanical accessories for laboratory work would need to be stored or held up pending the completion of the new building, but experience has taught us that almost everything which has arrived so far has been put to immediate use. Some large pieces of apparatus, which can be applied only in connection with a permanent building having adequate facilities in the way of power, have not been called for, because no prospect of their use, however necessary, could be seen until space could be provided by the new structure. This statement especially refers to the machinery which will be needed for experimentation on commercial subjects and for the larger apparatus necessary for the expeditious preparation and packing of serums. The vacuum distilling plant, which will handle 150 pounds of material at a time, the large extractors and other appliances connected with the work on essential oils, rubber, gutta-percha, etc., have not as yet been ordered, but will be on hand in time for installation in their permanent quarters.

Up to the present time the laboratories have constantly been in need of microscopes, the supply always being insufficient for the demand. There are on hand five Zeiss instruments, two of Bausch & Lomb, and one Zeiss dissecting microscope, and eight more instruments are on the way. These will probably fill the immediate needs so far as the workers in the biological, entomological, botanical, and serum laboratories are concerned, but they will not more than cover this ground, and additional instruments will be purchased as funds become available.

The supply of chemical balances has been increased somewhat during the present year, but the instruments are still overcrowded. Two more are on the way. The laboratories have long felt the need of a

large balance with a normal set of weights for the purpose of checking the instruments of other bureaus of the government, and a set of apparatus to cover this demand has been ordered, but is not yet on hand. An adequate assay outfit to meet the demand for this class of work has been ordered. In the meanwhile, the only available place for assaying is at the mining bureau, the laboratory of which has been placed at our disposition through the kindness of Messrs. Burritt and McCaskey. The complete appliances for assay work in the bureau of government laboratories will probably arrive in the near future. The laboratories are fairly well supplied with microtomes and other large biological apparatus, with platinum ware and appliances for carrying on routine work.

Experiments with the purpose of furnishing an adequate gas supply have been carried on, and toward the close of the year 1902 a machine for preparing gas from cocoanut oil was purchased, the principle of which is one of destructive distillation of the oil in a red-hot iron retort. The amount of fuel consumed and the quantity of oil necessary for supplying the building has not been great, and the gas has been of a quality equal to that supplied by any of the larger institutions.

At present the chemical laboratory uses about 200 cubic feet per day. Results with this type of apparatus have been so satisfactory that it is proposed to install the same class with a larger tank capacity in the new building.

CHEMICAL LABORATORY.

The chemical laboratory has been compelled to meet a continual call for work from other bureaus, many of the analyses being complex and taking a considerable amount of time. Its force has been limited chiefly because of the lack of room, and also for the reason that it has been difficult to obtain chemical workers from America.

The range of work was varied. A number of analyses of suspected counterfeited silver coins for the custom-house and treasury were made; examinations for poisons, some of which were for chemico-legal purposes, and involved testimony in court, were undertaken, and investigations of stains, in cases of suspected murder, for the purpose of determining the presence or absence of blood have been asked in two instances. Analyses of mineral and other waters have been asked, and requests for reports on soils, coals, paints, alloys, etc., have been made. The exposition board has submitted a large number of minerals for assay and for partial analysis, and the work in this direction has been pushed as rapidly as the force would permit, one man being continually detailed for this purpose. It is hoped the results of a systematic series of assays will give us a fairly clear conception of the distribution of gold and silver in the islands. The samples so far submitted have come from northern Luzon, Masbate, and Camarines. In preparing the exhibits, if the materials can be furnished, as large a number of coal analyses as possible will be made, and the laboratory will endeavor in other ways to assist in determining the chemical nature of many of the exhibits to be sent to St. Louis.

Unfortunately during the past year the limitation has been such that no one chemical worker has been able to devote his time to research work, and such investigations as have been accomplished have been undertaken at odd moments when for the time being no large pressure

of analytical work was felt. It has, however, been the aim of the laboratories to completely finish the work on india rubber and gutta-percha which it began in the past, and in order to prepare a complete bulletin on the subject in time for the exposition at St. Louis, Doctor Sherman has been sent on a second expedition to the southern islands with the purpose of completely filling in those portions of his previous work which had been left open. This subject it is to be hoped is now exhaustively covered, and a map showing the distribution of gutta-percha and india rubber, together with the methods of collecting and marketing the same, will form an excellent guide for manufacturers and producers.

A brief exploration of Mindoro was also undertaken by Doctor Sherman, where a new source of rubber was discovered, the latter being apparently of a superior quality. Samples of this product have been submitted to manufacturers in America for valuation.

The superintendent of government laboratories, together with Doctor Sherman and representatives from the mining and agricultural bureaus, made a trip to Paragua, because it had been reported that the true *Dichopsis gutta* occurred in this little-known island. Although the region was covered from Tai Tai in the north to Balabac in the south, neither gutta-percha trees nor india-rubber vines were encountered, the results proving negative in this respect, excepting in regard to the valuation of Paragua as a gutta-percha and india-rubber producing region.

The location on this island of the tree producing gum dammar was studied, and a considerable quantity of the resin brought to Manila for exhibition purposes and for investigation.

Accompanying the india-rubber and gutta-percha investigations, the laboratory has endeavored to undertake a course of study of the gums and resins of the island, and Mr. Bliss began, and has to a large extent completed, a line of work comprising the so-called "brea." The examinations so far conducted have shown that a number of trees produce products similar to the "brea" of commerce, from which oil of elemi is extracted. The essential oils obtained from these various sources varied, and one sample produced a large percentage of almost pure pinene. The particulars of this work will be given under the report of the chemical laboratory. Examinations of manapo oil, panao oil, tapulao resins, and others have been undertaken, and it is hoped that in the course of the next year, with a sufficient laboratory force to push the work, a systematic report, covering a large percentage of the gums and resins of the islands, can be prepared. Two samples of mineral oils have been brought to the laboratory for analysis, both being surface oils. The nature of one of these was such as to warrant the advice for further exploration.

The advantages to the government of the chemical laboratory, in addition to the necessary analytical work demanded in the Philippine Islands, must lie in systematic investigations of the resources of the archipelago, in the study of methods for improving present manufacturing conditions, and in demonstrating the value of products at present neglected. It would, for example, be of the highest importance if a sufficient force of workers were on hand to systematically investigate the possibilities of cement production, and a bulletin giving complete data on this subject for the benefit of the government and of manufacturers would be of sufficient value in cheapening the price

of cement to pay for the expense of the undertaking. The same conditions apply to coals. A systematic determination of the value of Philippine coals, based upon a complete series of analyses and investigation of the fields, would finally place our knowledge of this important product upon a firm and definite basis.

While the islands produce a considerable number of essential oils which have a sale in the markets of the world, it is unquestionably true that many flowers as yet unstudied would increase the range of this class of products, and activity in this line will be undertaken as soon as apparatus for the proper carrying on of the work is available. The vegetable products of the archipelago in relation to the preparation of alkaloids and other substances of value in medicine have not been studied from a systematic point of view in the laboratory, but indications which we have had in the past show us that in the future a large field exists for this class of research.

The chemical laboratory will only demonstrate its true value to the government if it can have a sufficient staff to enable it to properly carry out investigations of the class outlined above. The routine work and analyses need to be done, but the largest returns must be expected from research work tending to improve the commercial conditions of the islands. Besides inadequacy in the force at present available, the laboratory has been hampered by lack of collectors. In order to systematically survey a field such as would be necessary in the study of cement products or of coals, it will be essential to have men at the command of the institution who can be sent to the various regions of importance to completely survey and map the territory. Such research work as has been attempted in the past has always been hampered by the fact that the source of supply has been intermittent and substances have been investigated which have come from widely different areas in the islands and which presumably have no connection.

Vegetable products of economic importance are often brought to the laboratory, but the statement as to their source, the trees or plants from which they come, and all other data are so meager that no basis for report of value on the extent or distribution of the products derived from them could be made. In the case of india rubber and gutta-percha the bureau was compelled to spare its leading man in the chemical laboratory in order to obtain proper data for the preparation of a bulletin on this subject. In future requests for appropriation a collector for the chemical laboratory will be asked for, and it is hoped that within a year the institution will be in a position to investigate commercial subjects covering an extended area and to prepare bulletins of great value for the economic advance of the islands.

THE TRANSFER OF THE SERUM LABORATORY FROM THE BOARD OF HEALTH.

On January 30 of the current year, act 607 of the Commission transferred the serum laboratory from the board of health to the bureau of government laboratories, and Dr. James W. Jobling was appointed director of the serum laboratory. Some development of this portion of the bureau had taken place under the board of health, but owing to varied duties of that body, as specific attention as was needed could not be given to the preparation of serums and vaccine; as a result, the vaccine virus used in the islands had deteriorated through successive

years until it was of but little value. The preparation of rinderpest serum had suffered a set-back by the introduction into the paddocks of foot-and-mouth disease, and the absence of virulent blood to keep the immune herd in the state of highest efficiency.

The energies of the new director were at once turned toward obtaining a herd free from all disease, to quarantining all animals in future admitted to the laboratory, to improving the vaccine virus by a fresh importation from Japan, and to obtaining a regular and sufficient supply of small animals, such as guinea pigs and rabbits. With the addition of the buildings mentioned above the serum laboratory was soon in a condition to do efficient work. Foot-and-mouth disease disappeared, the systematic care and feed of the cattle brought about a betterment of their conditions, and since the first of February the laboratory has never lacked for efficient vaccine virus and for a sufficient quantity of rinderpest serum. The herd of immune cattle has lately been increased to about eighty animals, and new ones are being purchased as opportunity permits. The great call for its serum is evidenced by the fact that over 4,000 animals have been immunized in the provinces; that several thousand doses have been shipped to Shanghai for use with the Government cattle to be imported, and that some quantities have been sold.

The demand for vaccine virus has been unprecedented, and during the past six months 900,000 doses have been prepared. The board of health has made an extended call for Shiga prophylactic against plague, and up to the present time some 4,000 c. c. of this substance have been placed at its disposal.

The necessity for plague serum has always been felt, and the only reason why it has not been manufactured in Manila has been from lack of means and the possibility of systematic work. The serum laboratory began the purchase of horses as soon as it was transferred to the bureau of government laboratories, and now has on hand five animals which are rapidly being brought to the point where they will yield serum of good efficiency. Eight hundred cubic centimeters of antipestic serum have already been prepared and disposed of. The rapid development of this work, the health of the animals, and the discipline and system prevailing in the serum laboratory reflect the highest credit on its director. The facilities of the laboratory will be increased as time goes on, and the bureau will soon be in the position to furnish on demand all classes of serums and prophylactics which may be needed in the islands.

The laboratory has cooperated with the board of health in inoculating cattle against rinderpest, and expeditions, composed of employees of both institutions, have been sent to various parts of the islands. At the present time every assistance in the power of the bureau is being rendered the insular purchasing agent in the care of the animals which are being imported for the purpose of restocking the islands.

The connection which the laboratories have had with the importation of horned animals has brought to its attention the fact that practically a number of diseased ones arrive with each shipment. This condition emphatically calls for the establishment of a cattle quarantine station at Manila and for the necessary improvements thereon to enable the board of health to efficiently and promptly handle all shipments; to control sick animals; to inoculate such as need this treatment, and to prevent the introduction of further disease into the islands. After

the work of inoculation has been extended over the Archipelago, it will be necessary to prevent the reintroduction of rinderpest, and quarantine stations at the main ports of entry in the provinces will be the only means by which this can be done.

The pressure of work on the serum laboratory has been so great that none of the employees have been able to devote any time to investigations, all of their energies being directed to the actual manufacture of serums and prophylactics, which are in steady demand. The scientific force has been very limited; in fact it may be said that the director is the only one in this laboratory who has had adequate experience and training, with the exception of Dr. John G. Slee of the board of health, who has practically been detailed to the serum laboratory, and whose assistance has been of the greatest value. Unfortunately the emergency brought about by the purchase of cattle at Shanghai has rendered it essential to send Doctor Slee to that port, and this has left the laboratory without his efficient help. This condition has been felt by the Commission, and an effort has been made to secure the services of a thoroughly trained assistant director from America. As yet the government has not been able to ascertain whether the proper man has been found.

The advantages of research work in the serum laboratory are obvious. If, for example, careful investigations would develop means to so increase the potency of the rinderpest serum as to diminish the necessary dosage by one-half, the expenses of the laboratory would be cut down in proportion, and the same is true of all other lines in which the institution is engaged. In the course of the next year it is hoped that a sufficient number of scientifically trained men will be on hand to obviate the danger of loss in efficiency to the laboratory through sickness or other causes, and to enable it to carry on investigations which will diminish the cost of production and increase the efficiency of its products. The immunization of cattle against rinderpest is more successful and in better operation to-day in the Philippine Islands than in any other part of the world. The perfecting of the technique of this work and its successful application are due to the efforts of the bureau of government laboratories, and with such results to point to, it is but fair to its employees to recognize that they can not continue unless a sufficient number of men are engaged to enable the ones on hand to have some time for rest and recuperation, and opportunity for the more interesting phases of original work. The details of the work of the serum laboratory will be found in the report of the director.

BIOLOGICAL LABORATORY.

During the past year the force of the biological laboratory has been augmented by two men, Doctors Wherry and Wooley, who arrived in Manila on January 28. These additional workers formed a welcome increase in the laboratory force, because the pressure of the diagnostic work for various hospitals and bureaus had become so great that the limited number of men on hand were no longer able to keep up with it. During the past six months the demand for this class of assistance from the bureau of government laboratories has increased very rapidly, approximately 7,000 diagnoses having been made. In addition 20,000 rats and mice have been received at the laboratory for examination to determine the presence or absence of plague, 4 medico-legal cases

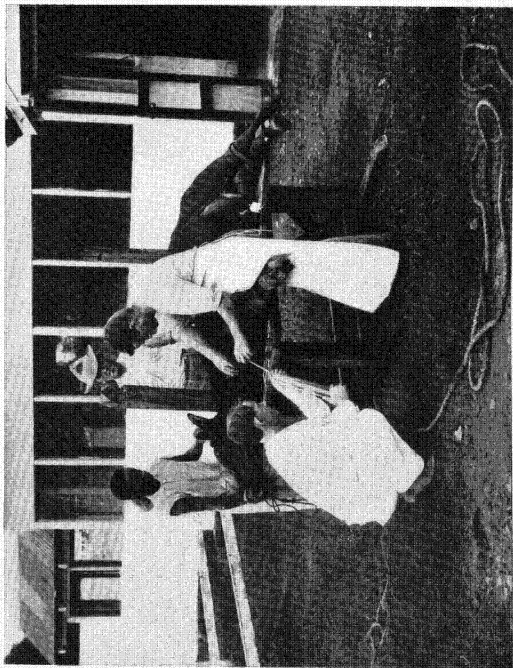


FIG. 10.—BLEEDING AN ANIMAL FOR ANTIRINDERPEST SERUM, SERUM LABORATORY.

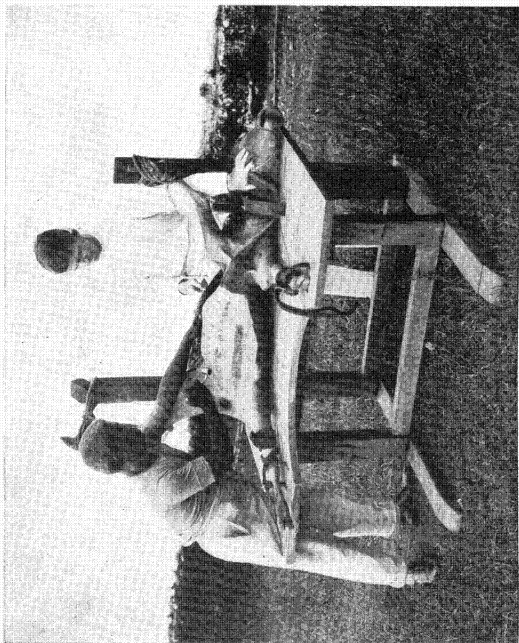


FIG. 11.—METHOD OF PREPARING VACCINE AT SERUM LABORATORY.

have been handled, 500 tissues prepared for microscopic work and a large number of post-mortem examinations undertaken.

For a time culture media prepared in the biological laboratory were furnished to the serum laboratory, but subsequently this was found to be inexpedient and the serum laboratory is now manufacturing a large proportion of its own.

Endeavors to do research work have been limited by the demand for diagnoses, and the same conditions prevail in the biological laboratory as are found in the chemical and serum laboratories and the same need exists for a sufficient force to enable men here to take some recreation and rest. The largest piece of investigation has been that of Trypanosoma and Tripanosomiasis by Doctor Musgrave, assisted by Messrs. Clegg and Williamson.

One of the duties of the force of the biological laboratory which interferes with the use of their time in their proper sphere of work lies in the clerical details which need to be performed in the entering and filling out of the prescribed blank requests for diagnosis. This portion of the work of the bureau could more properly be performed by a man who could be engaged at a much smaller salary than the scientific corps should receive, and it is to be hoped that a record clerk to take charge of these duties will be authorized at the beginning of next year.

The biological laboratory, just as is true of the chemical laboratory and the serum laboratory, will need to have a sufficient force to enable it to do research work. The exposure of a community in the Tropics to the various diseases incident upon its location is constant, and the importance of an adequate study of the results of tropical infection and their causes can not be underestimated.

The laboratory force in an institution such as the biological laboratory should be, for practical purposes, divided into two sections, the clinical section, which has to deal with diagnoses, and the pathological or research section, which devotes itself to the investigation of tropical diseases. All men in this line of work coming from the United States necessarily lack training in the field of tropical diseases, and the proper system should be to have them first take up work in the clinical section until they are acquainted with the various affections which they may encounter. Much of the clinical work is interesting, especially to those beginning tropical work, and a moderate amount of it broadens the pathologist and furnishes data for investigations. On the other hand, a continuous grind at the microscope, without time to follow up interesting results, becomes monotonous, and in the end decreases his efficiency. After ample experience has been gained, the employees in clinical work should have an opportunity to be promoted to the research division whenever vacancies exist. The gradual increase of the number of employees engaged in biological research work is looked for, and it is to be hoped that in the course of the next year even more important results with research work will be accomplished than have been shown during the twelve months just ending.

Dr. W. E. Musgrave was acting director of the biological laboratory from December 15, 1902, to July 15, 1903, taking the place of Dr. Richard P. Strong, who was absent in Europe on leave. Doctor Musgrave, in addition to his numerous duties, was able to prepare a very extensive and creditable investigation on the subject of "Surra,"

carrying on his work in the fly-proof stable at the serum laboratory. His results in brief have already been published in a preliminary bulletin, and the extended report is soon to appear.

The study of surra in the Philippine Islands has made it evident that this is one of the greatest dangers to which domestic animals can be exposed. The loss by death of horses contracting this disease in the Philippine Islands has been enormous, and consequently the investigations carried on by Doctor Musgrave formed a basis for the recommendation to the board of health of a quarantine law for horses imported into the islands, and also as to the means of destroying the infection at present existing. It is to be hoped that some action on this subject can be taken by the board of health and the Commission in the near future. Recently another disease of cattle was introduced from China. The value of efficient laboratory service was demonstrated by the fact that the disease was recognized, its nature and dangers determined, and steps taken to prevent its spread by the force of the serum and biological laboratories within a week of its appearance.

Doctor Strong returned to the islands on the 15th of July, after having spent a number of months in study in Berlin, and no doubt the results of his experience will be seen in the important research work which will be produced from the laboratory in the next year.

ENTOMOLOGICAL WORK OF THE BUREAU OF GOVERNMENT LABORATORIES.

Mr. Charles S. Banks, after passing the civil-service examination, was engaged by the bureau of government laboratories on December 9, 1902, and was immediately dispatched to Negros for the purpose of studying the insects which are destroying or interfering with the growth of the cacao plant, and also for suggesting such remedies as may be possible in destroying parasites attacking this valuable shrub. His work covered four months, and was mainly carried on at Maao, where large plantations exist. Inasmuch as no work had previously been done in the economic entomology of the Philippines, nothing was known practically of the extent to which cacao is injured by insects. It was therefore necessary to gather all data on insects affecting the plant in general, including roots, trunk, leaves, flowers, and fruit. A large number of specimens were collected, covering all forms of insect and myriapod life found upon the cacao trees, a collection secured of forms attacking the roots, including eggs, larvæ, and adults, and other forms attacking the branches, twigs, leaves, flowers, and fruit. A number of specimens of the wood which had been attacked were secured in connection with the insects causing the destruction, and many photographs were taken.

A few other places in Negros were also visited by Mr. Banks, and through this increased range of his studies he came to the conclusion that the insect pests are alike on all plantations in that region. Since his return to Manila Mr. Banks has been engaged in working up and classifying his material, and the results will soon be published in a bulletin which it is hoped will be of great value in assisting cacao growers to preserve and protect their plantations. The value of bulletins of this nature, founded upon actual experience, is great, and if the entomologists of the laboratory assist the agriculturists by such means the value of their services to the general public will soon be

recognized. An assistant entomologist, Mr. J. L. Webb, was secured at the instance of the forestry bureau for the purpose of studying the insect life harmful to the forest growth of the islands. As yet his work is not far enough advanced to speak of the results accomplished thereby.

The prevalence of malaria, surra, and other diseases transmitted by biting insects demonstrates the necessity of a systematic study of the mosquitoes and biting flies of the islands and the adoption of means for their extermination. An entomologist can not be engaged in problems involving agriculture in one district and in work on mosquitoes in another at the same time, and the need of more workers in the field, so as to enable the bureau to cover at least a portion of the ground in a reasonable time, is evident. It is hoped the entomological division will not only show rapid progress in the future, but will also be able to attract investigators from other parts of the world.

THE TRANSFER OF THE BOTANICAL WORK TO THE BUREAU OF GOVERNMENT LABORATORIES.

Botanical work is continually demanded by at least three bureaus of the government, and it would therefore seem logical, following the plan adopted with other laboratory work, to combine all botanical work under one head, and the bureau of government laboratories would obviously be the institution where it could best be cared for. The library already is partly organized, and much of the equipment needed by other scientific workers in the bureau is the same as that which would be employed by the botanists, so that obviously this course would prevent duplication both of equipment and of books. The interests of the government laboratories frequently lie in directions which are concerned with the properties of medicinal plants, dyes, tanning substances, gums, and resins, and are therefore immediately associated with the work of systematic botany, and moreover vegetable pathology is closely allied to other lines of pathological work.

The question of identification of plants will therefore constantly arise in the bureau, and botanical work would need to be carried on in it. The result, provided botanists were engaged in other bureaus as well, would be a duplication of work. The present status of botanical investigation, being divided as it is between the bureaus of agriculture and of forestry, entails more or less loss of time, owing to conflicting demands, and also more work than one man can hope to accomplish.

At the present time it is impossible immediately to secure more botanists, nor will it be possible for the laboratories to give all the space to botanical work which is necessary, but the transfer of such force and equipment as is now on hand could be made at once, and during the next six months assistants could be obtained from America. The demands at present call for at least one assistant botanist to help Mr. Merrill, the botanist, in the work, and for two collectors, who should be qualified to go to the provinces and obtain material. At least one man should be in Manila all the time to care for the material which is coming in. This involves a force of four men at the present, and it is believed that, with careful training, well qualified assistants can be developed from among the natives of the islands. The botanical collectors, if in the bureau of government laboratories, could also

assist in bringing in material which is necessary for chemical investigations, and would thus materially advance the interests of the entire institution.

If the transfer of the present botanist of the agricultural bureau to the bureau of government laboratories is accomplished, and when his assistant and two collectors are on hand, it is certain that the bureau of government laboratories can carry on work satisfactory to the other departments of the government which are interested in this line of investigation. In the new building sufficient space for laboratory work and for herbaria can be furnished. When the clerical force of the bureau is fully organized, it will be able to carry on the work of cataloguing and classifying the material belonging to the botanical laboratory as well as that of the entomologists. Eventually it will be advisable to organize a botanical laboratory under a director, who should be a thoroughly trained plant pathologist and physiologist. This director should be obtained during the course of the next year.

The agricultural and forestry bureaus have purchased a number of books and sets relating to botany, which, after January 1, 1904, should be transferred to the library of the bureau of government laboratories. The bureau itself will endeavor to round out and complete the botanical library and will thus consolidate one more line of scientific work with the central organization.

Original specimens should be kept in the laboratory herbaria and duplicates sent to the various scientific institutions for identification. It is certain that the organization of the botanical laboratory according to this plan will result as successfully as it has in the case of the chemical, biological, and serum laboratories.

THE WORK OF MAKING MICROSCOPIC SECTIONS FOR THE FORESTRY BUREAU.

In accordance with a request submitted by the chief of the bureau of forestry, Mr. J. J. Eaton, of the bureau of education, was engaged in the bureau of government laboratories during his vacation for the work of preparing microscopic sections from the different kinds of wood found in the Philippine Islands. In all 48 varieties were examined.

Some difficulties were experienced in softening the wood tissues so that they might be cut with a microtome, but a 20 per cent solution of potassium hydroxide finally proved fairly satisfactory. The softening of the various kinds of wood takes from four to twenty-four days, according to the variety, some extremely resistant ones requiring heating with the solution in an autoclave. After softening and removing water by means of successive alcohol baths, the tissues were mounted in celloidin and cut by the microtome. The results were in every way satisfactory, as it developed that different kinds of wood and the qualities thereof could be readily determined by this means. Specimens of two of the photomicrographs taken from these sections demonstrate this fact. The preliminary report of Mr. Eaton is appended, and the complete results of his work will be published in conjunction with the bureau of forestry.

THE LABORATORY OF WEIGHTS AND MEASURES.

The proposed laboratory of weights and measures was mentioned in the last annual report, and since that time the necessity for such an institution has become more apparent. Requests for certification of weights and measures are now frequently made of the bureau, but so far it has not been able to meet the requirements. A certain amount of this class of work can be undertaken when the balances and standard weights arrive, but it will not be until a physical laboratory is completed that systematic and comprehensive results can be expected. This laboratory is of the highest importance, and it is recommended that a physical chemist and assistant be engaged as soon as the new building is ready for occupancy. Most of the apparatus needed for this work will be on hand at that time, and steps are now being taken to order a number of more important pieces, including a dividing engine for lineal measurements. A charge should be made for business done for private individuals, and this would materially add to the income of the laboratory.

THE MARINE BIOLOGICAL LABORATORY.

The feasibility of establishing a marine biological laboratory in conjunction with the bureau has been in the mind of the superintendent of government laboratories since its organization, but the conditions did not seem favorable for suggesting this new departure in laboratory work in the Philippine Islands, because the efforts of the persons interested in general laboratory work necessarily were directed towards establishing those lines which were more immediately necessary and which could give results, the advantage of which would be obvious in the beginning. It is, however, certain that the study of so large and important a source of food supply as is given by the marine life in the waters surrounding the archipelago can not be indefinitely neglected. The field for investigation is enormous. The activity of the laboratory would be limited only by the means at its disposal, and the results would be extremely valuable both from an economic and a scientific standpoint.

It is to be realized that the value of such a laboratory, just as is the case with all others, can not be measured from the standpoint of commercial advantage only. The islands and the people are advancing in civilization, and in order to encourage this advance no more interesting and important line of work than that undertaken by a marine biological laboratory can be mentioned. The central institution for this class of work might with advantage be located in Manila, where an aquarium, such as is found in the city of Naples, although not so elaborate, would add greatly to its value as an economic institution; substations could be established at other points in the islands, and proper dredging machinery could be attached to one or two of the smaller government vessels without great expense. It is apparent that a marine biological laboratory should be organized, if at all, as a branch of the bureau of government laboratories, because the same arguments in regard to duplication of laboratory facilities, apparatus, and workers apply to it as do the other established divisions of the work.

SCALE OF CHARGES FOR LABORATORY WORK.

During the past six months an important move has been made by the laboratory in the adoption by the Commission of a resolution authorizing work for private parties according to a scale of charges to be approved by the honorable the secretary of the interior.

Manila has been without adequate private laboratory facilities, and physicians requiring diagnoses or business men and others needing analyses have been compelled either to forego the results which were needed or to send material to other countries. This has been obviated by the present system, and a steadily increasing income has been brought to the laboratories, the chief demand having been for mineral assays.

The serum laboratory as yet has not been authorized to sell its products to private individuals, nor indeed has this been feasible, because no surplus has been on hand. It is, however, obvious that once the plant is established and the manufacture of serums well under way, a very slight addition in the cost of the whole will enable the laboratory to supply serums and prophylactics to the outside world. A small beginning has already been made in the sale of antirinderpest serum to parties in Shanghai, and it is hoped that this business can be increased in the various tropical countries to such an extent that a large share of the expenses of the serum laboratory will be met thereby.

A scale of charges for work done for other bureaus has been in force for the past six months, and the result shows the actual money value of the work performed by the bureau of government laboratories. However, the fact that such a course necessitated a duplication of appropriation has led the Commission to change the conditions in such a way that now the laboratories will need to submit only an annual report of the value of such laboratory work, had it been charged according to the same scale of prices as is adopted for private individuals.

THE CLERICAL FORCE OF THE LABORATORY.

The laboratories have depended upon the two stenographers of the bureau for all clerical work since its organization and up to the 1st of January. This was possible because the large orders from abroad had not been received, and the amount of property and the necessity for issuing considerable quantities to individual employees was not so great as to seriously interfere with the correspondence of the bureau. When, however, large shipments began to come in, and when a store-room where individual appliances could be kept was established, a clerk to adequately care for the property of the bureau and to protect the interests both of the government and the superintendent of laboratories became necessary, and Mr. H. S. Peabody, stenographer to the superintendent of government laboratories, was promoted to the new position. The development of the library then necessitated the employment of a librarian, and this change actually brought into the bureau two clerks in addition to the stenographers, and the growth of the serum laboratory, together with the important records which needed to be kept in regard to all animals purchased, inoculated, and sold by the bureau, rendered clerical assistance for the serum laboratory imperative.

Even with this force the work during the past six months has increased in such a measure that all the employees engaged in the care of property and of records were compelled to work overtime. A laboratory uses daily many hundreds of small items, such as test tubes, pipettes, burettes, surgical instruments, needles, knives, etc. It requires feed and other supplies for the care of the cattle and incidentals such as lime and carbolic acid for disinfecting the stables; it must account for all animals purchased; must handle numbers of small animals, such as guinea-pigs and rabbits, so that in a thousand and one ways, the proper preservation of the property of the bureau becomes a great task. In order to have supplies available in sufficient quantity so as to enable laboratory work to be carried on, purchases must be continually made and a careful account kept of the condition and quantity of all chemicals and apparatus on hand. When certain things are called for in a laboratory they are frequently needed at once, and in amounts sufficient for the purpose for which they are to be used. Delays may often cause not only serious inconvenience, but great loss, so that a constant and proper knowledge of what is available is necessary. The details of requisitions, although they may not amount to a great sum in actual money value, nevertheless, consume much time. Since the 1st of January the scale of charges has gone into effect, and the property clerk of the bureau, who was the only person available, was made cashier. The checking of all blanks to prove the scale of charges to be correctly applied, the handling of the returns, and the keeping of books thus added materially to the clerical work. A well constituted and efficient clerical force will in the long run save much more money than it costs, not only in preventing abuses incident to a careless handling of property, but also in keeping supplies of the proper quality and in sufficient quantity on hand without allowing extravagance, and in administering the somewhat complex scale of charges. For this reason it has been proposed by the superintendent of government laboratories to maintain a bonded clerk and cashier, who shall have general supervision over the property and who shall have direction of all clerical work in the bureau, which later will be placed in a separate laboratory division termed the "clerical division." An additional duty devolving upon this cashier and upon his employees will be the proper maintaining of time and pay rolls, as well as the control of the janitors and laborers employed in the laboratory buildings, together with the supervision of the immediate care of the apparatus in stock. Delicate pieces of scientific machinery rapidly deteriorate in this country if constant vigilance is not exercised. It is believed that all necessary work can be accomplished by the employment of one bonded officer in charge of the clerical division, a property clerk, a record clerk for assistance in keeping scientific records, an employee for general clerical assistance, the clerk of the serum laboratory, and the necessary stenographers for the several directors. This clerical force will be constantly busy on full time, and would be sufficient to allow legal leave of absence to its employees, a condition which is now impossible.

A BILL FOR REORGANIZING THE LABORATORY AND FOR PROVIDING AN ADEQUATE FORCE FOR THE SAME.

The history of the bureau has been such that advances have been made along the lines which experience has demonstrated to be most necessary. Employees have been engaged from time to time, some

from the United States and others from the Philippine Islands, as the needs increased, at such salaries as might secure a reasonably stable personnel. A graded system of remuneration could not be inaugurated because it was almost impossible to predict what the demands of the laboratory would be, hence all consideration of this desirable system was postponed until the superintendent could be certain of his ground and sure of the knowledge that all positions which would be requested could be properly filled. A draft of a bill reorganizing the bureau has been submitted to the Commission for final action, and in this the plan for graded salaries has been rigidly followed. If it is adopted employees can enter the laboratories at the lowest point, for which it is hoped a remuneration of \$1,400 per annum will be authorized. Opportunity for advance to the highest salaries in the bureau by promotion through regular steps, all of which are connected, will then be given.

Evidently such a system can not be put into effect at once. Considerations of justice to the present employees must be taken into account, so that the bringing in of such a scale of salaries must be gradual until the authorized positions are all filled. This final condition should be reached within a year and a half from the present writing. The bill was so drawn as to give the ultimate positions and salaries, but these would not go into effect until by resolution of the Commission the positions should be duly authorized.

Experience has shown that in some respects act 156, organizing the laboratories, and act 607, amendatory thereof, do not cover the ground necessary for the permanent institution, although both acts have admirably met the conditions up to the present time. The duties of the superintendent have greatly increased in scope and complexity. The buildings and property under his charge have been added to, bulletins have been published, for which a uniform system of editing is necessary, and when the new building is occupied its care and the use of all materials for general scientific work, as well as of employees who can not be assigned to any one laboratory, must fall entirely under the superintendent. For this reason the power of the superintendent has been somewhat increased in the proposed draft of the bill. In it provision is also made for the publishing of bulletins and for a plan by which the bureau can offer its facilities to visiting scientists or to such as wish to carry on research work in its buildings and subject to its rules.

The time has almost come when the superintendent will be able to accommodate prominent scientific guests who wish to come to the Philippines for the purpose of research work, and it is earnestly hoped that the Commission will make provisions for such visitors, giving them the privileges of the laboratory, and, in certain selected cases of men who come here by invitation, paying their expenses from their point of departure to Manila and return. It is believed by the superintendent that, provided guests come to the laboratories under these conditions, the results of their investigations should be available for publication in the laboratory bulletins. The advantages to the islands of the presence, for limited periods, of masters of scientific investigation engaged in various lines of work, will be far in excess of any expense which such investigations will involve, and in order to prove this standpoint it is only necessary to call attention to the great benefits which have accrued to the world at large by the scientific tours authorized by various governments in the past.

THE COOPERATION OF THE BUREAU WITH SCIENTIFIC SURVEYS IN THE UNITED STATES.

Suggestions have been made in the past for the establishment of adequate scientific surveys of the Philippine Islands to be conducted by bureaus in Washington. It need scarcely be pointed out that the bureau of government laboratories, with its efficient library and its facilities for accurate scientific work, will be a great aid in cooperating in any plans which may be perfected in this respect. Botanical and geological surveys can have their matter classified or their mineral analyses made on the spot; a guide would be given in this way for the next steps which expeditions of this character would make, and the knowledge of certain regions of the islands would be markedly increased by cooperation. The scientific staff of the laboratories will always have in its midst men of experience in tropical conditions as well as in the geography of the islands and in the distribution of its various natural resources. By their advice and cooperation, workers coming from America, whose knowledge of such conditions must necessarily be limited, will be materially assisted. The superintendent of government laboratories believes that any plans formed at Washington looking toward the scientific surveys of the islands, should take into consideration the facilities for work already on hand and should be mutually elaborated by the home forces as well as by those engaged in scientific work in the Philippine Islands. A separation of the two would only result in a disadvantage to both, and a candid and frank recognition of the merits of the work both in Washington and in the Philippine Islands will be the only method by which the best results can be obtained. If a system of exchange between employees in the bureau of government laboratories and those in similar lines of work in Washington could be arranged, it would tend to bring the institutions into closer contact and would be of material advantage to all concerned.

THE WORK OF THE GOVERNMENT PHOTOGRAPHER.

During the year the government photographer has been kept steadily at work, chiefly in taking negatives of interest from an ethnological standpoint. He has accompanied members of the bureau of non-Christian tribes on expeditions to Benguet, Bontoc, and Mindoro, has taken over 500 negatives and made more than 2,000 prints therefrom, and has thus obtained a permanent record of the conditions prevailing among non-Christian tribes in the islands, as well as of their manners and customs. This series of negatives must be of greatest assistance in a scientific study of the peoples of the Philippines. Some of the tribes, by reason of changed conditions, will necessarily gradually abandon old customs, conditions may change by reason of intermarriage, migration, or changed environments, and the permanent record obtained by these photographs will then serve as a gauge to the degree of variation.

Other bureaus, such as those of forestry, architecture, and agriculture, have made use of the government photographer, and in one instance photomicrographs of textile fabrics have materially assisted the custom-house.

The pressure of work has become so great that an assistant photographer has been engaged, and by this means many demands which have been delayed owing to lack of time have been met. The making of photomicrographs must be done in the nighttime, and the result has been that in order to meet requests in this direction the photographer has steadily been compelled to work overtime. It is hoped that this condition can in the future be remedied by the increased assistance which has been accorded, but it would also be reasonable, provided the demand for photographs increases in the future as rapidly as it has in the past, that the photographer be allowed pay for overtime work.

DWELLING HOUSES FOR GOVERNMENT EMPLOYEES.

The surroundings of the employees of this bureau have never been satisfactory. Rooms or houses within reasonable distance of the laboratory have been difficult to find, and such as are available are not infrequently very undesirable from a hygienic standpoint. Illness of employees has crippled the laboratory force from time to time. When the bureau is moved to the Exposition Grounds it will probably be even more difficult to obtain suitable quarters at a reasonable rental. It is believed that the benefits which would accrue to the service, not only in the bureau of government laboratories but in others as well, by the building of adequate and satisfactory government houses for government employees would be very great. The possibility of obtaining good dwelling places at a reasonable rental would improve the service because of the greater contentment of the employees, their more efficient work owing to the fact that they would need to travel shorter distances to their places of business, and the diminished danger of illness. Arrangements by which employees who intend to remain permanently in the service could purchase their houses on long terms would probably be extremely advisable.

THE RELATION OF THE LABORATORY TO THE GENERAL HOSPITAL.

Modern medical science has advanced to the point where intelligent hospital practice is impossible without the complete cooperation of a well-equipped laboratory; and, conversely, productive research is not possible to a biological laboratory without the intelligent cooperation of a hospital. For this reason the superintendent of government laboratories has repeatedly urged that a general hospital, when established, should be placed in close proximity to the laboratory buildings, and it is gratifying to perceive that this view has finally come to be the one adopted by the general hospital committee. The ground on which the laboratories are situated belongs to the government. It is ample for the purposes of the laboratory building, the wings for the various other scientific bureaus, a general hospital, a medical school, a home for nurses, and probably other structures as well. The situation is a good one, and the ultimate relationship brought about by such a group of buildings will be ideal.

Progress in the laboratory in the past has been satisfactory, but many important problems are yet unsettled; the proper solutions of

them depend upon careful and well conducted research. In the future, as well as in the past, the liberal support of such work will be a matter of financial economy to the insular government.

I am, very respectfully,

PAUL C. FREER,

Superintendent of Government Laboratories.

THE SECRETARY OF THE INTERIOR,
Manila, P. I.

EXHIBIT A.

**REPORT OF THE DIRECTOR OF THE SERUM LABORATORY, DR. JAMES W. JOBLING,
COVERING THE PERIOD FROM JANUARY 1, 1903, TO AUGUST 31, 1903.**

During the first part of the fiscal year, and while this laboratory was under the control of the board of health, my health had suffered from the effects of overwork and the debilitating climate, and I was given two months' leave of absence with permission to visit Japan. This time was spent studying the methods of preparation of serums and prophylactics used by Professor Kitasato in the Government laboratories, Tokyo, Japan.

I can not speak too highly of the kindness shown me by Professor Kitasato and his assistants during my stay with them, every facility and assistance being put at my disposal. During the most of this period I was making a study of the production of antiplague serum, it being one of the most important diseases with which we were then contending in Manila.

Rinderpest having suddenly become epidemic in the city of Manila, Doctors Strong and Musgrave began the preparation of antirinderpest serum, and at the time of the return of the director a considerable quantity of this material was on hand.

Rinderpest having been reported on the island of Tablas, Veterinary Surgeon John G. Slee and Assistant Director Charles S. Sly, with 4½ liters of serum, were sent to the island to inoculate all the cattle and carabaos in the surrounding barrios by the "simultaneous method" and to treat those animals already sick with large doses of serum. A detailed report of the work done by them will be given under the heading of "Rinderpest inoculations."

Toward the latter part of October, 1902, all rinderpest work was stopped by the development of foot-and-mouth disease among the serum animals, which of course prevented their further use until they had completely recovered.

One experience convinced us of the impracticability of doing much work as long as foot-and-mouth disease was present in the laboratory. The serum animals having recovered, five nonimmune animals were purchased to obtain virulent blood for further inoculations. They were placed on a portion of the laboratory grounds which it was thought had not been previously infected either with foot-and-mouth disease or rinderpest, but we were very quickly undeceived. On the second day all developed foot-and-mouth disease, and on the fifth rinderpest. The combination proved fatal, as all the animals died in a few days—in fact sooner than we have ever seen animals die which had contracted rinderpest alone.

Because of this experience a quarantine stable was erected in which all animals could be placed under observation for a sufficient number of days to prove the absence of foot-and-mouth disease or to effect its cure, so that all danger of a subsequent development would be reduced to a minimum. The grass within a radius of 15 feet of this stable was removed, enabling us to thoroughly disinfect the ground in its vicinity. The excreta were disinfected with crude carbolic acid and lime, and the entire building whitewashed with a solution composed of lime and carbolic acid. This was repeated every time an animal was removed from the stable. Finding it to be impossible to have the native attendants take the proper precautions so as to prevent the transfer of the infection to the remainder of the grounds, mats kept wet with carbolic acid solution were placed at each gate. These were sufficiently large so as to make it almost impossible to pass through the gate without disinfecting the feet or shoes, but in addition everyone passing from one lot to another was directed to thoroughly cleanse his feet upon these mats.

In the beginning the virulent blood of those animals having both rinderpest and foot-and-mouth disease was not used for inoculating the serum animals, but after

experimenting on several and finding no bad effects to be produced we ceased paying any attention to the combination when it occurred in an animal having rinderpest. Not many animals with the combination of infections were used, so it is impossible to state whether the absence of bad results following these inoculations was due to an immunity following a previous attack. It was known that a number of the old serum animals had recovered from the disease and were thus at least partially immune, but there were on hand several bullocks which were not at the laboratory during our epidemic, and their hoofs did not show the corrugations usually found on the recovered animals.

On January 1, 1903, this laboratory was transferred from the board of health to the bureau of government laboratories. At this time the laboratory equipment was very incomplete, a large list of apparatus having been ordered but not received until later.

The work has been greatly retarded by lack of assistance and became still more so when Asst. Director Charles S. Sly was ordered to Shanghai on April 26 to supervise the prophylactic inoculation against rinderpest of carabaos which the government is purchasing at that point. In a great many instances the force was found to be greatly insufficient, a large amount of work which should have been done being left untouched. This applies more especially to the preparation of other serums, some of which we were compelled to order from Japan.

Again, the fact that our present location is but temporary, so as to make any very expensive improvements inexpedient except on permanent grounds, was an impediment, as it prevented us from making certain improvements which would greatly have facilitated the work.

RINDERPEST SERUM.

As stated previously, this work was started in September, 1902, while the director was in Japan, by Doctors Strong and Musgrave. A description of the preparation of this serum is given in the accompanying circular, entitled "A preliminary report on the study of rinderpest of cattle and carabao in the Philippine Islands," as follows:

This preliminary report is especially intended as a circular of information to the cattle shippers and breeders of the Philippine Islands, giving them the symptoms, means of prevention, and treatment of rinderpest, and, as a consequence, scientific discussion and technical terms have been avoided wherever possible. The civil government intends to immunize all the cattle and carabao now on these islands, as well as those to be imported. To accomplish the best results, it is necessary for cattle shippers and breeders to become thoroughly acquainted with the disease in order to successfully cooperate in the work.

In the following, articles written by numerous authors have been consulted and free extracts made.

Definition.—According to Gamgee, "Rinderpest is a specific, malignant, and highly contagious disease, known to us only as the result of direct or indirect communication from sick to healthy animals. It never originates spontaneously, but is perpetuated by constant reproduction, after the manner of other contagious diseases. It is essentially a bovine disease, although it is claimed it may be communicated to swine, goats, sheep, deer, antelopes, gazelles, and zebras, seldom attacking any animal more than once." My own definition would be that it is a specific, infectious disease, characterized by congestion and inflammation of the mucous membranes, more particularly of the digestive tract.

It is marked by a period of incubation of from three to ten days; by fever, which precedes all other symptoms; redness of all the visible mucous membranes, seen early and in a marked manner in the vagina of cows; sometimes delirium and muscular twitching; discharges from the eyes and nose; normal secretions checked or suppressed; abdominal pain with diarrhea, although in certain instances there may be constipation. In some epidemics a scaly eruption on the back and loins and a characteristic one on the inside of the thighs and on the mammæ, together with fetor of the breath and discharges are observed. The majority of animals seized with rinderpest die, and, after death, decomposition rapidly takes place.

The following brief historical retrospect is taken from an extract of Fleming's work on Animal Plagues, and Gamgee's work on Cattle Plague, as given by Edington in his annual report to the colonial secretary, Cape Town, for the year 1897.

The date of the first account of a disease among cattle, which probably was rinderpest, is given as A. D. 69. Columella, who lived at that time, and who, according to accounts, had considerable influence on the progress of veterinary medicine, has written of many of the diseases of the lower animals. In the ninth chapter of the sixth book, in describing the symptoms of the fever, he says:

"The fever is present when the tears are running down the face; when the head is carried low and heavily, and the eyes are closed; when the saliva flows from the

mouth; when the respiration is shorter than in health and seemingly embarrassed, or sometimes accompanied by groaning."

He further insisted on the most sensible procedure of separating the sick from the healthy stock.

Since that time epidemics of greater or less extent have from time to time attacked the cattle on large areas of the globe.

Rinderpest has caused the death of several million cattle in Europe alone. In A. D. 360, eastern Europe was visited by an epidemic of an exceedingly virulent character, which caused an enormous loss, the cattle apparently dying almost as soon as they became sick; in A. D. 591 Italy, France, and Belgium developed a scourge which left scarcely sufficient cattle to breed from; in the year 694 England suffered from an epidemic which caused unfold suffering, and during the year 801 France was again severely afflicted.

From this period up to the beginning of the eighteenth century, when our knowledge of epizootic diseases becomes more exact, numerous epidemics of a virulent disease appeared among cattle in all parts of Europe, causing immense loss and great suffering.

In 1708 Kanold asserts that rinderpest had commenced its destruction in Russia, from which country it spread to all parts of Europe. Of all the descriptions of this epidemic relating to the nature and spread of the cattle plague, probably the best are those of Lancisi and Ramazzinni, two physicians who gave special attention to the disease. Their description of the symptoms corresponds with those encountered in the Philippine Islands with this exception: I have never seen, either at this laboratory, where the animals have contracted the disease by means of natural infection and by inoculation, or in the provinces, where the disease is contracted by natural infection alone, cases covered with pustules and small tumors. From the frequency of the pustules in the cases observed by Lancisi and Ramazzinni, they concluded that the disease was similar to and identical with smallpox in man.

In Holland, during the year 1713, 200,000 animals are supposed to have succumbed to the disease, and between 1711 and 1714 over 1,500,000 died in western Europe; in the interval between 1840 and 1843 Egypt lost over 665,000; in 1865, 500,000 were destroyed in England, and from 1884 to 1894 Russia lost over 1,815,000.

The disease is now present in India, China, Africa, the western part of Russia, and is said to be endemic in the Balkans.

In the Philippine Islands rinderpest apparently first appeared in 1882, when the Spanish Government issued a pamphlet instructing the people in methods of diagnosis and treatment, and from this period until the present time it has extended to most of the islands of the archipelago, causing a loss of many of the cattle and carabao, estimated by some to be as high as 90 per cent.

METHODS OF TRANSMISSION.

The cause of rinderpest is not known, but from its being so very infectious, and from the fact that it is so easily conveyed by the blood, it is probably produced by some microorganism the nature of which we have been unable to determine. The infection is carried but a very limited distance in the atmosphere or by running water. The usual method of transmission is by means of infected ground, but it can also be conveyed by any of the excretions, such as the discharges from the nose and mouth, the stools, and, according to some authors, by the bile; by buckets and other objects which have been in contact with the sick animal; by means of the indiscriminate disposal of the offal or by allowing the excreta to pass by way of an open drain into or through a pasture containing healthy cattle; by means of men attending sick animals and carelessly carrying the infection upon their shoes to a place where healthy cattle are kept; by dogs or wild hogs, which, if allowed access to the carcass of an animal dead with rinderpest, may tear it to pieces and scatter the bones and fragments of flesh to new areas of ground, which thus become infected. It can also be conveyed by means of the hides removed from animals dying of rinderpest. One source of great loss to cattle shippers is in transporting cattle on ships which, without proper disinfection, have previously been transporting diseased animals.^a

^a This latter danger has been shown conclusively during the work in this laboratory, where we are compelled to obtain our calves for vaccine virus and cows for the preparation of serum from China. With but very few exceptions every shipment of calves or cows we have received has either shown some of the first symptoms of the disease (high temperature) on admission or has developed the same within twenty-four hours.

One instance of this occurred very recently. Fifty calves were five days in transit from Hongkong to this port, and within seventy-two hours after admittance to this

In experimental work it has been proven that 0.1 c. c. of blood taken from a sick animal and injected under the skin of a healthy one is sufficient to reproduce the disease.

Edington states that if a small amount of the discharge from the nose of a sick animal be rubbed on the muzzle of a healthy one the latter will contract the disease almost as quickly as if it had been inoculated with virulent blood, but if this discharge be kept twenty-four hours before applying to the healthy animal the disease is greatly modified in type. He further mentions that in localities in which redwater or Texas fever was present, and where he was afraid to inoculate with virulent blood for fear of conveying the Texas fever parasite, he diluted the blood with a large quantity of water and drenched the animal with it. In these cases they contracted the disease about as quickly as when inoculated. In a series of experiments, made in order to find out the maximum length of time rinderpest would live in the dried state, he added sufficient blood to dry sawdust to give it a bright-red color and allowed the mixture to stand at room temperature for six days. He found that 2 grams of this mixture would produce the virulent disease.

Hutcheon states that complete desiccation destroys the infection, and that putrefaction apparently has the same effect.

From the above it will be very readily seen what a great mistake it is to allow an animal sick with rinderpest to remain at large, with the subsequent danger of infecting all the remaining stock in the vicinity. If a few precautions were taken the danger would be reduced to a minimum.

GENERAL PATHOLOGICAL ANATOMY.

The body is emaciated. There is often an excoriation of the skin below the inner canthus of the eye, produced by the irritating discharge during life. The tail and buttocks are often soiled by the fecal discharges.

So far I have been unable to determine any specific cutaneous lesions, especially none of those reported by the older writers.

In one case (carabao), in which the animal was sick about twenty days, a pustular eruption appeared about the fifteenth day. This eruption was discrete, but the pustules were very close together and scattered over the entire surface of the body, apparently showing no predilection for any one part.

The natives in the provinces claim that many of the convalescent animals show a scaly appearance of the skin, but we have never noticed this condition in a sufficient number of cases to be able to say that it generally accompanies the disease.

The skin covering the upper lip is often thickened and excoriated by the discharge from the nose.

The conjunctivæ are nearly always congested, more especially in carabaos, in which animals they are generally a bright-red color. I have seen a number of cows sick with rinderpest, where the conjunctive showed practically no changes. These cases generally occurred in animals which had been inoculated with the disease.

The mucous membrane of the nose generally, and over the septum in particular, is deeply congested. It often appears of a purple color. In a few cases I have noticed superficial ulcerations on the anterior portion of the septum, but I am inclined to think that they were due to some other cause.

Most writers upon rinderpest lay stress upon the frequency with which ulcers are to be found in the mouth. This is contrary to our experience at this laboratory, for while the great majority show a marked congestion of the mucous membrane, with a covering of thick, slimy mucus, comparatively few show ulcerations.

Ulcers sometimes appear on the dorsum of the tongue, accompanied with marked congestion.

The fauces and pharynx are the seat of a catarrhal inflammation and covered with thickened mucus.

Edington states that in many of his cases the tonsils showed pin-head abscesses in the cortical layer.

The mucous membrane of the œsophagus and trachea, as well as in other parts of the body, may be deeply congested, but in the majority of cases appears normal.

laboratory for immunization 20 were dead. In this case 2 died within twenty-four hours after admission, while, with the exception of 4, all showed a temperature of 41° C. or over.

As the incubation period of rinderpest is from three to ten days it can be seen that the infection must have taken place either aboard the ship or in Hongkong just previous to shipping, as after arriving at the laboratory the majority died before they had passed the regular incubation period, whereas if the infection had taken place here the animals would hardly have shown serious symptoms before eight or ten days.

The lungs generally appear perfectly healthy. In some cases there is a congestion, but I believe this to be principally hypostatic, due to weakened heart action. A number of cases showed an emphysematous^a condition.

The pericardium contains about the usual amount of fluid and appears normal. The parietal lining sometimes shows a few subserous hemorrhages.

It is not uncommon to find petechiæ (minute dark-red points) scattered over the surface of the heart.

The muscular tissue is generally paler than normal, and shows a condition of marked cloudy swelling. In the cavities of the heart the blood seldom coagulates firmly, either forming a soft coagulum or having a sirupy consistence. The endocardium or lining membrane often shows minute hemorrhages.

The general lymphatic system seems to be affected in this disease, as in the majority of cases almost all of the lymphatic glands of the body appear enlarged, and in some cases present an edematous appearance. This condition is best seen in the abdominal cavity, where the glands in the mesentery supporting the small intestine are almost invariably greatly enlarged, and in some cases hemorrhagic.

The rumen (first stomach), the reticulum (second stomach), and omasum (third stomach) are generally normal in appearance, although the contents of the last are always very dry and the mucous membrane sometimes slightly congested.

The abomasum (fourth stomach) is usually the organ in which the most marked pathological changes are found. The contents are generally fluid, and consist of a large amount of mucus and often of considerably blood mixed with the food. The odor is very foul.

The changes in the mucous membrane vary from a slight congestion, generally localized at the pyloric or lower end, to an extreme one with ulcerations, involving the mucous membrane of the entire organ.

Very often minute hemorrhages about the size of a pin head will be found over the deeply congested areas. Numerous small ulcers are often present, more often at the pyloric or lower end. They are generally shallow, with the bottoms covered by a greyish-yellow exudate. I have seen cases in which the ulcer extended completely around the pyloric orifice.

The upper portion of the small intestine is invariably congested, almost to as great an extent as is the fourth stomach, and it often shows the minute hemorrhages so frequently observed in the latter. I have never seen more than two or three cases in which there were ulcerations in this location; these are apparently confined to the fourth stomach and cæcum.

In the severest form of the disease, the feces show casts from 12 to 35 centimeters in length and post-mortem examination demonstrates a diphtheritic condition of the upper portion of the small intestine with pseudo-membraneous formation.

In many cases the mucous membrane of the remainder of the intestine is so slightly affected as to appear normal, while in others there is the most extreme congestion, with the formation of casts. Peyer's patches are often enlarged, but, in my experience, never ulcerated. I have never seen ulcers in this portion of the intestine. A marked congestion is very often seen around the ileo-cæcal valve, with small sub-mucous extravasations of blood.

The cæcum is generally merely the seat of a congestion, but in other cases it is violently inflamed, showing ulcerations, hemorrhages, etc.

The colon is frequently congested, but the changes are not so far advanced as those seen in the upper part of the small intestine and in the fourth stomach.

The peritoneum often shows signs of an acute localized inflammation, involving that portion covering the small intestine, which is often coated with a fibrous exudate.

The peritoneal cavity usually contains a larger amount of fluid than is found in a healthy animal.

The liver is greatly congested, often presenting a mottled appearance, and shows evidence of marked cloudy swelling. It is frequently bile-stained.

The gall bladder is distended with bile, which is usually green in color, but I have seen all shades, from a light yellow to black. The mucous membrane usually appears healthy, but sometimes is markedly congested, covered with a tenacious mucus and showing the petechia or pin-head hemorrhages described above as occurring in the fourth stomach and elsewhere.

The kidneys are congested, in some cases showing numerous petechia scattered over the capsule of the organ.

The surface of the spleen appears of a slate color and wrinkled. The organ does not appear to be greatly congested and is about normal in size.

The vagina is always greatly congested.

^a Dilated air cells in the lungs.

The mucous membrane of the bladder, like that of other portions of the body, may be deeply congested, but is usually normal. Some cases present a hemorrhagic appearance.

SYMPTOMS.

Our observation of rinderpest resulting from natural infection has been almost entirely confined to the disease occurring in animals which have contracted it previous to their admission to this laboratory, but which have shown the first symptoms two or three days afterwards, and to that developed by individuals which have been put on a small area of ground, previously infected by the excreta and discharges of animals dying of rinderpest. The animals were tied to stakes which had been driven into the ground in the center of the infected paddock, and their food was placed in such a position as to mix it more or less with the infected excreta.

The incubation period in those animals contracting the disease from this exposure varied within a range of from six to ten days. In no case have I seen it less than six days. The earliest rise of temperature observed is about fifty-one hours after inoculation with nasal mucus (Edington).

In animals inoculated with virulent blood the incubation period is from sixty to ninety-six hours. The rapidity of onset and sometimes the intensity of the subsequent disease depending, first, upon the virulence of the disease in the animal from which the blood was obtained; second, upon the length of time the latter has been kept, and third, upon the quantity used for the inoculation. The average time before the first rise of temperature is about seventy-two hours. In case the animal is inoculated with a large dose (10 c. c. to 25 c. c.) a rise of temperature is often noticed on the evening of the same day, but the temperature generally falls to normal on the following morning and remains so until the period of incubation has passed.

Generally on the evening of the fourth day after inoculation a rise in temperature to 40 to 40.6 C. will be noted.^a It does not remain high in all cases, but sometimes drops to normal on the following morning, remaining so for twenty-four hours and then again rising to over 40° C., remaining high, with slight morning remissions until just before death, when it rapidly drops to subnormal.

The temperature curve in an inoculated animal is well shown in Chart No. 1.

CHART NO. 1.

Cow No. 45, November 12, 1902.

[Weight, 400 pounds; age, 2 years; sex, female; color, light brown; inoculation, rinderpest; history, inoculated November 14, 1902, with 5 c. c. virulent blood from calf No. 56.]

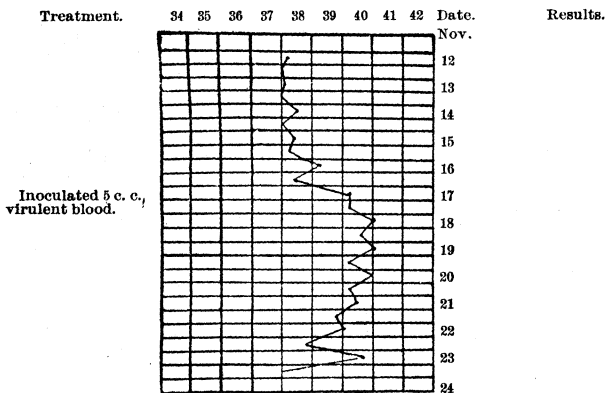
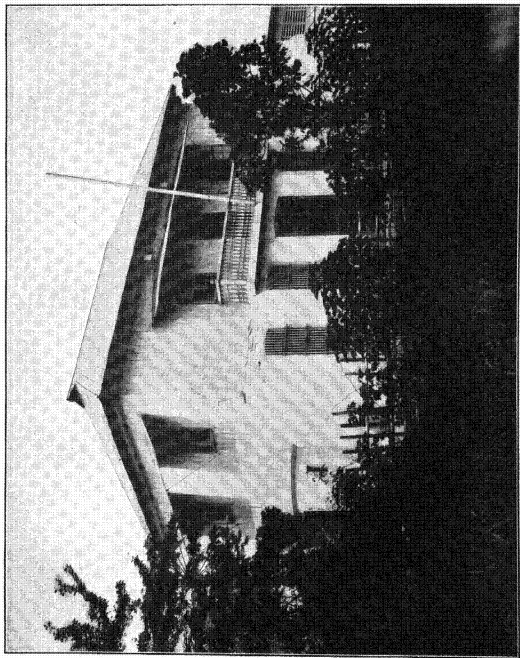


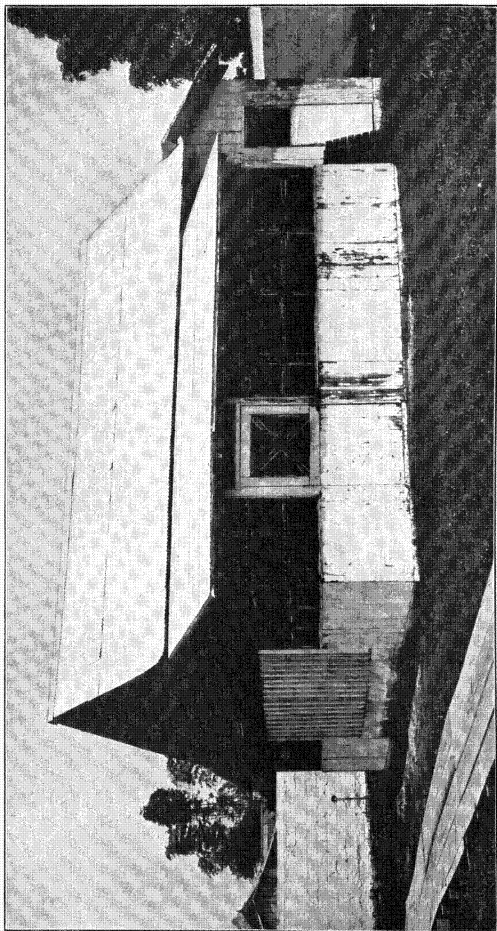
Chart No. 1.

About twenty-four hours after the first rise of temperature it will be noticed that the muzzle is somewhat dry, and the animal appears less inclined to take food. About the same time the mucous membrane of the inner portion of the eye becomes injected and soon presents a vivid pink color with a slight watery discharge running

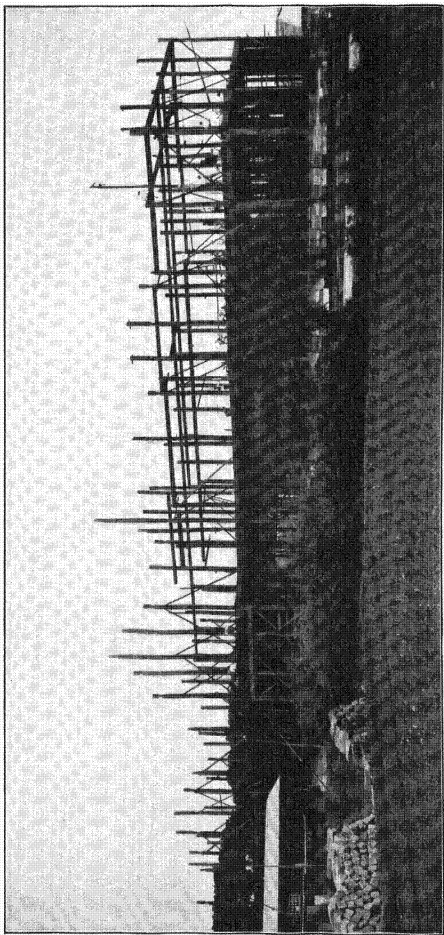
^a In the Philippine Islands a healthy cow's evening temperature will average about 39° C.



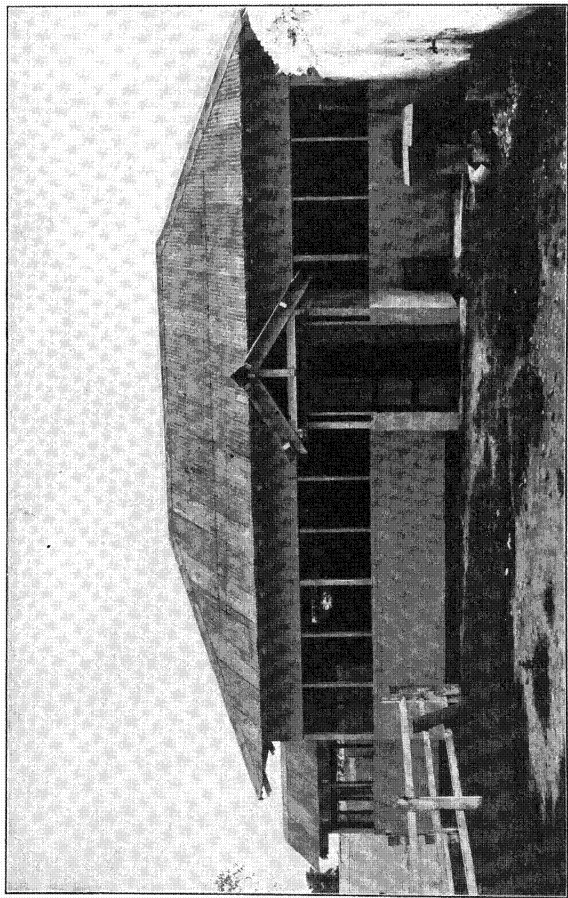
SERUM LABORATORY.



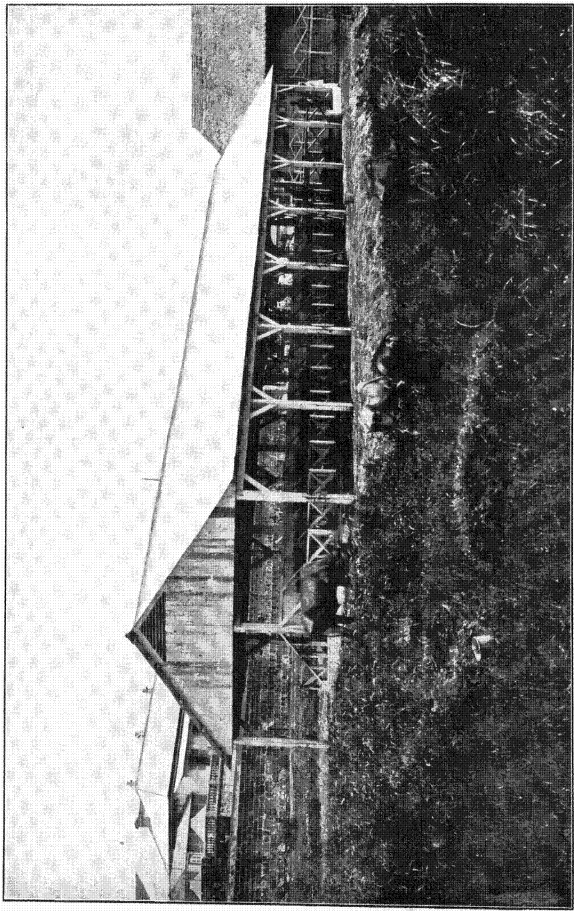
FLY-PROOF STABLE AT SERUM LABORATORY.



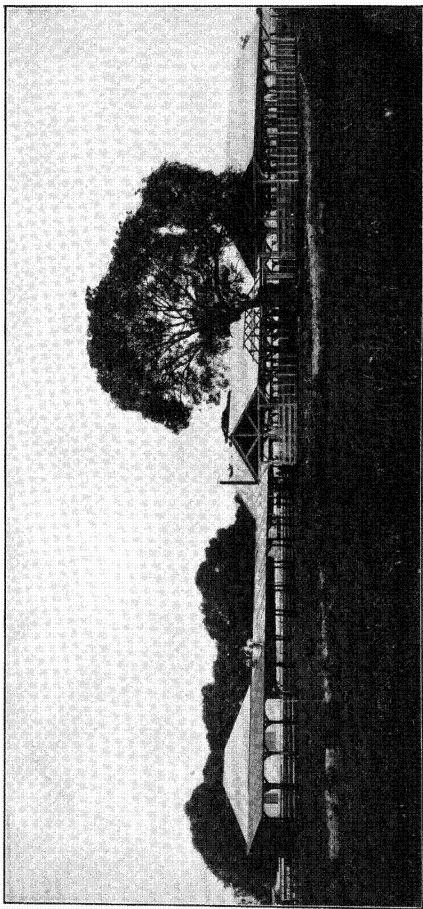
NEW LABORATORY BUILDING UNDER CONSTRUCTION.



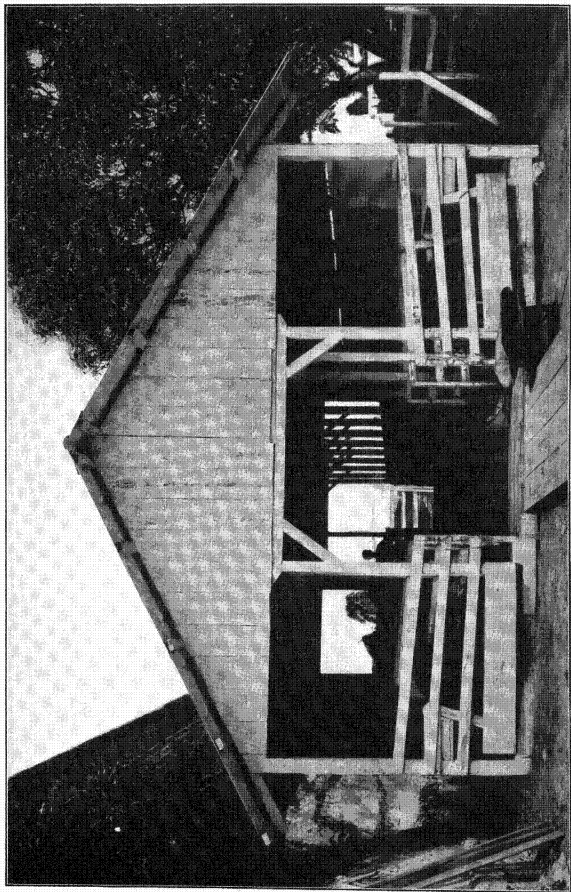
OPERATING ROOM AT SERUM LABORATORY.



CATTLE QUARANTINE STATION AT SERUM LABORATORY.

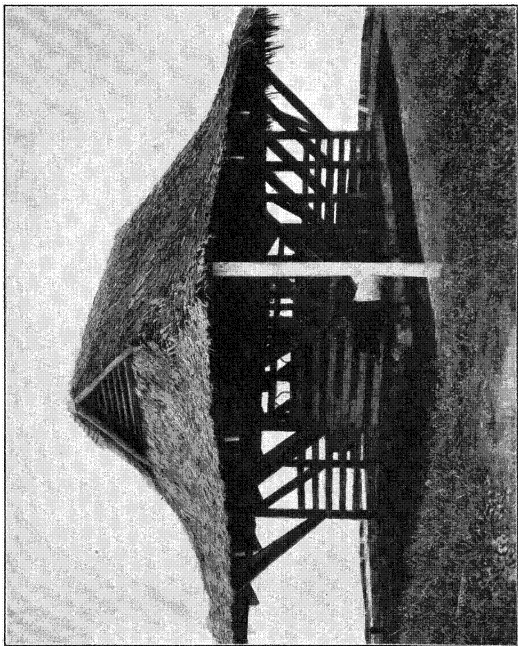


SHEDS AT SERUM LABORATORY.



DETENTION STALL FOR CALVES, SERUM LABORATORY.



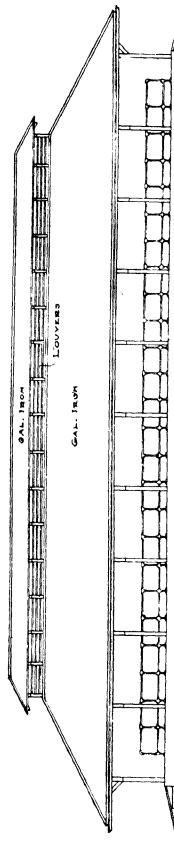


STABLE FOR VACCINE CALVES WITH SUN SHELTER.

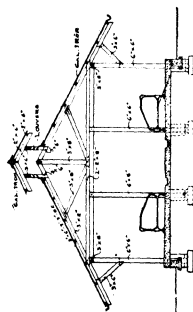


FIG. 5.—CATTLE USED IN PREPARING ANTIRINDERPEST SERUM AT SERUM LABORATORY.

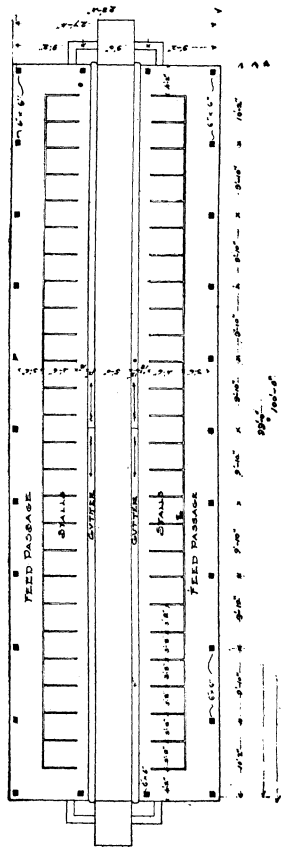
CATTLE STABLE for SERUM LABORATORY BUREAU of GOV. LABORATORIES



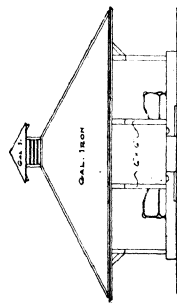
SIDE ELEVATION
SCALE 1/8"=1'-0"



CROSS SECTION
SCALE 1/8"=1'-0"



FLOOR PLAN
SCALE 1/8"=1'-0"



END ELEVATION
SCALE 1/8"=1'-0"

down the face from this point. In many instances this is the initial visible symptom of the disease. The mucus discharge from the nose is much augmented. The bowels are somewhat constipated, although the feces are often coated with slimy mucus. The hair is rough.

The animal shows great thirst; and if in the open, leaves the herd; and, if water is near, will stay by it; the ears hang forward; the head droops, while flies gather about it and no great effort is made to dislodge them. There may be twitching of the superficial muscles of the back, shoulders, or hind quarters; rumination is irregular or ceases, grinding of the teeth becomes almost constant. When the animal is lying down the head is commonly turned toward the flank. With the exception of those cases noted above, the temperature at this time is very high, in many cases being over 41° C.

About forty-eight hours after the first rise of temperature the hardened feces give place either to a foul-smelling, discolored watery discharge containing mucus flakes and blood, or to a dirty, thick, slimy fluid containing streaks of blood, and in some cases mucus casts. The other symptoms now all become aggravated. The discharges from the eyes, nose, and mouth are increased in amount, that from the nose is changed in character, being now thick and muco-purulent, while the skin of the upper lip over which the secretions have been running becomes thickened, dry, and excoriated. The breath has a very offensive odor. Prostration is very great; the animal while standing trembles from weakness; there is extreme thirst. It soon lies down, moaning; the liquid feces are passed almost continually with great straining, finally involuntarily, the animal groaning from the tenesmus. It rapidly becomes weaker, the respirations are more rapid and labored; finally, just before death, the temperature drops to subnormal.

The symptoms described above are not constant, either in the order given, character, or severity.

The duration of the disease from the first rise of temperature until death is usually from two to ten days, the average being about six.

If rinderpest is of a milder type, the stools after a few days lose the mucus and blood streaks, and gradually assume their normal consistency, all the other symptoms abating at the same time.

I have noticed that a larger percentage of carabaos than of cattle show the highly injected conjunctivæ, and that following the "simultaneous method" of inoculation, when a diarrhea does appear, it generally does so at an earlier stage with carabaos than with cattle.

The great majority of the animals which are affected die. Some authorities state that the mortality is from 60 to 80 per cent, but here in the Philippines I believe it to be much higher, especially in the rainy season. This is also noticed by the natives, who maintain that while in the wet season most of the animals die, in the dry season many recover.

In this respect it is interesting to note that in regions where wild hogs are numerous the natives state that they find dead hogs as the epidemic rises in extent and virulence. They explain this by the theory that the wild hog contracts the disease while eating the carcasses of animals dead with rinderpest. In the Pasteur Institute it has been found that hogs are susceptible to the disease, and in view of this the above does not seem improbable.

In this laboratory we have had no opportunity to experiment with wild hogs, but procured two farm-bred animals, one of which was inoculated with 5 c. c. of virulent blood. The animal appeared dull on the day after, had very little appetite, and was lying down most of the time, with no other symptoms. The temperature on the evening of inoculation was 39.5° C.

On the third day after the inoculation the animal showed distinct signs of illness, the back was arched; head hanging; no appetite; extreme thirst; conjunctivæ slightly congested, with a discharge from the inner angle of the eye; the hog lying down most of the time. The respiration was rapid. The morning temperature was 40.2° C., and the evening 40.4° C.

On the fourth day there was a profuse yellowish, watery diarrhea, the animal appearing to have involuntary discharges part of the time.

There was no mucus or blood in the feces at any time. With the exception of the diarrhea, the animal showed the symptoms it did on the previous day, although it was now weaker.

On the fifth day the diarrhea had disappeared; the animal was still very weak, but the temperature had dropped to normal. The hog was now bled to death, the blood being drawn into potassium citrate solution and used to inoculate hog No. 2 and cow No. 46.

The post-mortem showed no marked lesions, with the exception of a slight hyperæmia of almost the entire alimentary canal.

Hog No. 2 received 5 c. c. of the blood, but never developed any symptoms of the disease.

Cow No. 46 received 7 c. c. of the blood and, after the usual incubation period, showed the typical form of rinderpest, although the symptoms were much milder than is generally seen after inoculation with such a large quantity of virulent blood. Unfortunately no other nonimmune cattle were on hand to test the blood drawn from this cow, so that further experiments were prevented. This animal was bled to death. The post-mortem lesions were those usually seen in rinderpest, although not so far advanced.

This hog had the shortest incubation period of any animal I have seen, and I would have believed it to be suffering from some other disease had cow No. 46 not developed typical rinderpest after the regular incubation period.

From this one series of experiments it would appear that while the hog may contract the disease and die, and its excreta may form a source of infection for cattle and carabao, yet it is difficult for the sick hog to reinfect others of its kind. However, no definite conclusions could be based upon the evidence at my disposal, and the work will be continued when opportunity offers.

Some experiments are now being conducted in the provinces to determine the susceptibility of the wild hogs, and to see if they are able to communicate the disease to others.

PREVENTIVE MEASURES.

When an animal shows any symptoms of the disease as hereinbefore described, it should be immediately isolated. By isolation I mean that it should be entirely separated from the remainder of the herd and placed on a small inclosed area, so situated that after it dies or recovers the ground and everything which has come in contact with it can be thoroughly disinfected. It could be kept on the spot where found, temporarily fenced in, and with a bamboo and nipa covering to protect it from the rays of the sun. The excreta should not be allowed to enter a drain and so infect surrounding territory, but should be retained on the spot and thoroughly disinfected either with crude carbolic acid in a strength of about 3 per cent, or by the addition of good chloride of lime, or buried. The attendant, if a native and not wearing shoes, should thoroughly disinfect his feet as well as his hands with a per cent solution of carbolic acid before coming in contact with other animals.

If he wears shoes, he should have two pairs, one to wear while working with the sick animal, the other (which should be left on the outside of the inclosure) to be put on when leaving.

After the animal dies or recovers, the shelter should be burned on the infected area, and the entire surface of ground within the inclosure, as well as that on which the animal has been browsing or lying, disinfected with carbolic acid or chloride of lime. It would be still better, after sprinkling with carbolic acid or chloride of lime, to cover the ground with dry grass and then set fire to it.

The remainder of the herd must be transferred to new pastures and there kept separate from one another, and the temperatures of all taken daily. Any animal showing a temperature above normal, or any of the symptoms described, should be immediately isolated in the manner above described, and the herd once more moved.

By following these precautions I believe an epidemic of rinderpest can be suppressed in its beginning, and only those animals which are in the incubation stage at the time the disease is first recognized will further develop the disease.

The bodies of the animals which have died of the disease should be either burned or buried. It is better to burn them; but if this can not be done, care should be taken to bury them so deeply that hogs and other animals can not exhume them and scatter the bones and fragments of flesh around the surrounding country, in which event new points of infection would probably be formed.

A very careful search should be made for the source of the primary infection, so that after suppressing the disease in the herd it may not be reintroduced.

As the hides removed from animals dying of rinderpest convey the disease, they should be thoroughly disinfected with a 1 per cent solution of carbolic acid, allowing them to remain in this solution for several hours, and then hanging them in the hot sun until thoroughly dry, turning them over several times so that the rays of the sun will strike all parts. If they are to be sent from the infected locality, it would be better to redisinfect them before shipment. I have given directions for the disinfection of the hides because their retention may be insisted upon. My own opinion, however, is that it would be better to destroy them with the carcass,

IMMUNIZATION.

There are a number of different methods of immunizing cattle and carabaos against rinderpest, several of which will be described, with their advantages and disadvantages.

INOCULATION BY A MIXTURE OF GLYCERIN AND BILE TAKEN FROM AN ANIMAL SICK WITH RINDERPEST (EDINGTON'S METHOD).

Edington recommends the use of bile taken from an animal which has been sick six days, preferably from one which has contracted the disease by natural infection, because he found greater immunity conferred thereby than by that taken from animals inoculated with virulent blood.

The bile, according to his directions, should be green, having a white froth on the surface and possess no putrefactive odor. To obtain it, open the abdominal cavity of the dead animal, tie the neck of the gall bladder with two strong ligatures of twine and cut between them. The bile can then be secured by one of several methods, viz, immerse the bladder in a bucket of 2 per cent carbolic acid, then wash in cool water which has recently been boiled, and open the bladder with a knife which has also been boiled, allowing the bile to flow into a vessel recently sterilized by thoroughly washing with boiling water; or, after the bladder has been disinfected, the bile can then be obtained by means of a trocar and canula, hollow needle, or even a sharpened small piece of bamboo which has been sterilized. If found to be satisfactory, half its volume of glycerin is added to the bile, and the mixture is then kept in a cool place for eight days; after which it is ready for use. The inoculator should not take the bile from the dead cow, as he is liable to carry the infection to the animals he is inoculating.

Of the bile thus prepared, 15 to 30 c. c. is injected under the skin of the dew-lap. The syringe which is used for this purpose should be allowed to remain in a 3 per cent solution of carbolic acid for about thirty minutes, and before using should be washed out with water which has been freshly boiled. It would also be well to wash the skin where the inoculation is to be made with the same carbolic-acid solution. After ten days the animal should be reinoculated with 0.2 c. c. of virulent blood.

The advantages of this method are: First, there are practically no deaths following the inoculation; second, after preparing the bile it can be kept ready for use for about one year; third, pregnant animals seldom abort.

The disadvantages are: First, the immunity thus produced lasts a very short time, generally from two weeks to three months; second, very little immunity is conferred until after ten days; third, in some animals no immunity is produced at all; fourth, the small quantity of bile secured from each animal makes it necessary to allow a number of animals to contract the disease in order to obtain a sufficient amount for the immunization of the remainder of the herd; fifth, it requires two inoculations; sixth, it is necessary to bleed a sick cow to get virulent blood for the second inoculation.

SERUM METHOD.

Koch demonstrated that the serum of the blood taken from an animal which had suffered from rinderpest and recovered possessed immunizing powers.

The serum which is used for this and the following methods is prepared by inoculating cattle with gradually increasing doses of blood taken from an animal sick with the disease, until they can bear very large quantities.

The animal first receives the "simultaneous method" of inoculation hereinafter described. If it shows a good reaction, i.e., rise of temperature after the proper period, it is given 100 c. c. of virulent blood after the temperature again drops to normal.

This is subsequently, and under the same circumstances, followed by 500 c. c. and afterwards by 1,000 c. c.

If the animal does not show a good reaction within ten days after "simultaneous inoculation," it is given 10 c. c. of virulent blood. If a good reaction follows this dose, and after the temperature drops to normal, it received 250 c. c. of virulent blood, then ten days later (or after the temperature becomes normal) 500 c. c., and finally 1,000 c. c. After receiving a dose of 1,000 c. c. the animal is bled for serum.

In bleeding our serum animals, they are strapped upon the operating table, a small area over the jugular vein is shaved clean and sterilized with a 3 per cent solution of carbolic acid, followed by alcohol. The instruments are also sterilized in a 3 per cent carbolic-acid solution.

After sterilization is completed, a short incision is made over the course of the jugular vein. The latter being exposed, a trocar and canula are inserted into it. It is better, when the trocar is withdrawn, to attach a piece of rubber tubing to the canula, for if this is not done, the animal in its struggles may upset the vessel into which the blood is being drawn or cause the previously sterile vessel to become infected. The blood is allowed to flow into tall glass cylinders holding 500 c. c. each, about three liters being taken at one operation. It is then set aside for twenty-four hours, at the end of which time the clot will generally have contracted quite firmly and will be surrounded by the clear serum; this is drawn off by means of sterile pipettes or by a siphon.

After this operation the clots should be allowed to stand for an additional twenty-four hours, as at the end of that time some additional serum can be obtained.

Following Roger's plan, the animals, after receiving 1,000 c. c. of virulent blood, are allowed to remain until the temperature becomes normal. They are then bled three times with an interval of one week between each bleeding, after which they are inoculated with 1,500 c. c. of virulent blood and bled in the same manner as before.^a

In using the serum, 50 to 100 c. c. should be injected under the skin, using the precautions given above.

The advantages of this method are: First, that it produces no reaction; second, in dairy cattle there is no suppression of milk; third, the immunity conferred is almost immediate; fourth, if the disease is just developing, it will often modify the attack, making it much milder in type; fifth, there are no deaths as a result of the inoculations; sixth, pregnant animals do not abort; seventh, the serum can be prepared in any quantity and it will keep during seven or eight months.

The disadvantages are: First, the short period of immunity, it averaging from two to four months; second, the skill required in preparing the serum; third, I believe sometimes very little immunity is conferred, as I have seen cases in which a small quantity of virulent blood, given from ten to fifteen days after the inoculation of serum, would develop a virulent type of the disease.

As stated above, a great many calves received from Hongkong for vaccine work have shown some of the first symptoms of the disease either upon the day of admission or within twenty-four hours thereafter. For this reason we have been giving all animals which have shown a temperature above normal, 50 c. c. of serum upon the day of admission, the remainder receiving the "simultaneous method" described below.

In these cases where serum alone is given, and where it is desired to confer permanent immunity, the calf is reinoculated with virulent blood alone after ten days. To obtain a reaction in these cases we have found it necessary to give a dose of 15 to 25 c. c. of virulent blood when it is given within ten to thirty days after the primary inoculation, and even under these circumstances some calves will show no reaction.

SERUM SIMULTANEOUS METHOD.

This method, with the modification noted on page 20, is the one in use at this laboratory, as well as at the principal points throughout the world where rinderpest is prevalent. It was first used by Kolle and Turner in their work in South Africa. It requires more skill than the bile method, as it is necessary to first prepare serum and then to obtain virulent blood from another animal sick with the disease.

When we first began inoculating in this laboratory we used fresh virulent blood, but soon found that Edington's method of preserving it, in a solution of potassium citrate to prevent coagulation, was preferable. If the blood is kept in a cool place it can, according to our experience, be used for at least seven days with good results. Some authors maintain that it can be preserved for a longer period. The blood is drawn into a 500 c. c. sterile flask, which contains 25 c. c. of a 5 per cent solution of potassium citrate, so as to give 1.25 grams of potassium citrate to each flask.

In using this method, the amount of serum necessary (which varies from 15 to 50 c. c., according to the susceptibility of the animal, as determined by experiment with others in the herd) is injected under the skin on one side of the animal, and 1 c. c.

^a My assistant, Mr. Chas. S. Sly, has had charge of the preparation and handling of all serums, while Dr. J. G. Slee, assistant veterinary surgeon to the city of Manila, has done nearly all of the bleeding, had charge of all the inoculations, as well as the general supervision of the stock on hand. A great deal of credit is due them for their valuable work in assisting in the suppression of the epidemic now prevalent in these islands. Their work has not been confined to this laboratory, but has extended to the provinces, where they have inoculated a great many cattle and carabao.



ANIMAL WITH RINDERPEST, SHOWING DROOPING EARS, FLIES SETTLED ON THE BACK, TAIL DRAWN IN, AND GENERAL DEPRESSION.

of the virulent blood on the opposite side and at the same time. If this amount of virulent blood were given without simultaneous inoculation of serum, it would invariably produce the disease in susceptible animals, but as the latter is given at the same time, it not only produces immediate partial immunity, but also aids the system in overcoming the toxic effects of the virulent blood; as a consequence a rise of temperature only is noted.

A temperature curve showing a good reaction after inoculation by the "simultaneous method" is shown in Chart No. 2.

CHART No. 2.

Steer No. 72, December 31, 1902.

[Weight, 900 pounds; age, 4 years; sex, male; color, red; inoculation, rinderpest; history, inoculated December 31, 1902, with 1 c. c. virulent blood from cow No. 67, and serum 20 c. c.]

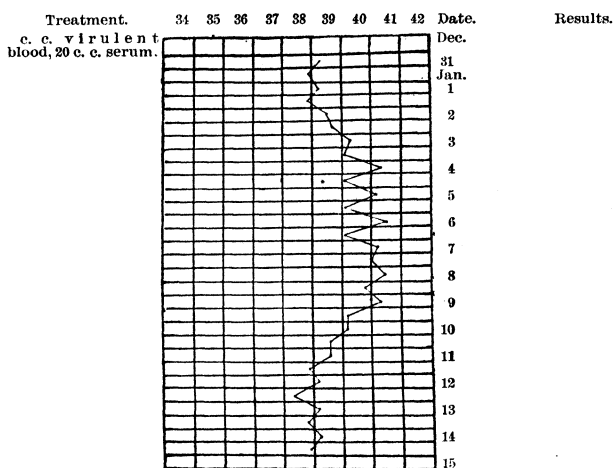


Chart No. 2.

The advantages of this method are: First, the serum can be prepared and kept on hand in large quantities; second, it confers immediate partial immunity, which becomes much greater after the resulting reaction, and if the animal is in the incubation period at the time of inoculation the subsequent disease may be modified; third, the reactions are more even, under better control, and the immunity lasts longer than by any bile method; fourth, only one inoculation is required; fifth, in animals showing a reaction the immunity conferred is very effective and lasts for years, while a temporary immunity probably lasting for several months is conferred upon the ones having no reaction.

The disadvantages are: First, the inability to perfectly control the reactions by the regulation of the relation between the dose of virulent blood and of serum; second, in order to obtain reactions in all animals, some cases require a second inoculation with virulent blood; third, to do the work properly it is necessary to take temperatures from the fourth day; fourth, the mortality, which is from 2 to 10 per cent, is higher than by any of the other methods described.

At this laboratory we use the simultaneous method as modified by Rogers. The modification consists in taking the temperatures on and after the fourth day of all the animals inoculated, and those showing no reaction from the first inoculation are reinoculated after ten days with 10 c. c. of virulent blood.

The advantages of this method are: First, a reaction is obtained more often than by any other method; second, it is shown in a much larger percentage of cases; third, those animals having no reaction after the second inoculation will have a longer immunity conferred upon them than by the serum or any of the bile methods, although it is probably not of long duration.

The disadvantages are: First, that second inoculations are required in some cases; second, beginning on the fourth day, it is necessary to keep temperature records of the animals, thus necessitating a larger force of inoculators; third, the difficulties

encountered in the provinces where the natives are in such marked opposition to the inoculations as to render it almost impossible in the outlying districts.

This method is to be preferred when practicable, as immunity extending over a long period is conferred upon the majority of the animals, while a temporary one is given to all. Rogers states that after a good reaction the immunity continues for years.

The work done at this laboratory has been of too recent a date to determine the duration of the immunity in this country, but it will undoubtedly accord with Rogers's experience.

DEFIBRINATED-BLOOD METHOD.

This method originally recommended by Rogers may be used by cattle owners themselves.

It is first necessary to find an animal which has just recovered from the rinderpest; it is then bled, with all the precautions given on page 17, the blood being allowed to flow into a wide-mouthed vessel which has previously been sterilized. Then with an ordinary egg beater or wire brush which has been boiled for at least fifteen minutes, the blood should be whipped for fifteen or twenty minutes, or until there is complete separation of the fibrin, which forms a stringy mass clinging to the egg beater. The blood can then be used, as it will not coagulate; it is to be injected under the skin in doses of from 50 to 250 c. c. It must be used fresh, as it will soon spoil. It confers an immunity lasting from one to four months.

I believe that where the blood from a recently recovered animal is to be used for treatment or immunization, it would be better to draw the blood into a sterile flask or vessel containing the potassium-citrate solution. This would do away with the danger of contamination, which is often very difficult to prevent in the process of defibrination.

The advantages of this method are: First, it produces rapid immunity; second, the defibrinated blood is easily prepared on the field when animals which have recovered from the disease are present; third, there is no reactionary fever.

The disadvantages are: First, only a temporary immunity is obtained; second, the blood can not be kept; it must be fresh when used.

This method is one which should be of great benefit in distant provinces where it is impossible to obtain help or means for inoculation by the "simultaneous method." As immediate immunity is produced, it will be seen that with the exception of animals which already have the disease in its incubation period, no more will contract rinderpest during one to four months, the epidemic thus dying in its infancy.

TREATMENT.

Most of the writers whom we have been able to review, and who have had experience with rinderpest, join in saying that no treatment is of any benefit when once an animal has contracted the disease, although some state that large doses of serum given subcutaneously exert a favorable action upon the course of the disease.

Serum has been used in very large doses with infected animals in this laboratory, but, with the exception of two or three calves, we have been unable to detect any difference in the course of the disease, although a number of cases showed a transient fall in temperature. From the foregoing it is evident that prevention is the best treatment for rinderpest.

In case an epidemic breaks out in a locality the local health authorities should see that the infected animals are isolated, with all the precautions described on pages 14, etc.

The source of the primary infection should be traced if possible, and when found suitable precautions should be taken to prevent reinfection after the disease is under control.

Where possible all the animals in the infected district should be immunized by the "simultaneous method." When expert help can not be obtained for this purpose the "defibrinated-blood method" or "Edington's glycerin and bile" method may be used by the cattle owners themselves.

Of these two latter methods I believe the "defibrinated-blood method" to be the best, as immediate immunity is produced, whereas with the "bile method" it is first necessary to allow the mixture to stand eight days before inoculating animals, and full immunity is not conferred until ten days after inoculation, so that after the first case appears it is eighteen days before the animals become immune.

As no treatment has any effect upon the course of rinderpest, and as it has been proven that an animal which has been inoculated and has shown a good reaction seldom contracts the disease, it is evident that it is not only necessary to inoculate

all the animals now in the Philippine Islands, but also those to be imported. By this means it will be possible to completely remove rinderpest from the islands, but if such precautions are not taken it will continue indefinitely, spreading from one point to another, killing off a large percentage of the young animals and so working a continual hardship on the people.

THE PROCURING OF VIRULENT BLOOD.

Our greatest difficulty lies in procuring nonimmune animals. Rinderpest has been prevalent in the Philippine Islands since 1882, and as it has passed over nearly all of the islands it can readily be seen that there is no certainty as to the results until after inoculating a native animal with a small dose of virulent blood. This inability to count on virulent blood just when it is needed for the serum animals seriously hampers the work. In some instances animals sick with rinderpest were procured from the corrals adjoining the abattoir, but as it was impossible to state just how long they had been infected they were only used in emergencies.

On numerous occasions animals purchased in Hongkong were tried, but as a certain number were found to be immune the expense was too great. Animals purchased in Cochin China were also experimented with, but the same trouble was experienced.

The most reliable animals purchased for this purpose were those from the island of Sibuyan, P. I. The natives say that rinderpest has never been epidemic on this island, but as the interisland boats are very irregular, especially to points on the island of Sibuyan, great difficulty even has been experienced in procuring these.

In the latter part of the fiscal year the work became more complicated by the presence of hemorrhagic septicemia, a number of cases developing in the government carabao shipped from Shanghai, while reports received from Hongkong stated that this disease is very prevalent in that locality. When hemorrhagic septicemia first appeared we were depending upon the development of rinderpest in animals from Hongkong for virulent blood to inoculate our serum animals, but this new complication necessitated a change in technique. We had previously been inoculating directly from the sick beast into the serum animal, which was kept in a stock near by, but after the development of the hemorrhagic septicemia the virulent blood was drawn into sterile flasks containing a 5 per cent solution of potassium citrate in such quantity as to give 5 per cent, or a sufficient amount to prevent clotting when the flask was filled. This procedure gives sufficient time to hold a post-mortem on the virulent blood animal before using its blood for inoculations. Where, on post-mortem, the animal showed any suspicious lesions, the blood was placed in the ice chest and cultures made from the different lymphatic glands and organs; if these were negative, it was used. While reports state that hemorrhagic septicemia is very prevalent in Hongkong, we have as yet seen but one case from that port.

This method of inoculating with virulent blood has not been in use a sufficient length of time to make any definite statement, but we believe that where the virulent blood is drawn into a citrate solution as described above and is then immediately used a stronger serum will be obtained. We are led to make this statement from observing the rapidity with which the blood is absorbed and from the more rapid and sharp reaction following the inoculation. In a great many instances where citrate was not used the blood clotting in the subcutaneous tissues would remain unabsorbed for a long time. In a number of instances the swellings induced by these injections were opened under the impression that they were abscesses and were then found to be large clots of blood which had apparently been walled off by the formation of fibrous tissue.

From this experience it would seem probable that any process which will prevent this change from taking place and at the same time hasten the absorption of the virulent blood will produce a sharper reaction and probably a stronger serum.

Difficulty in procuring nonimmune animals prevented our obtaining the dosage of our serum before using it in the provinces, as is recommended by Kolle and Turner, and so when starting the inoculation in any one province instructions were always given to take not more than ten animals, inoculating them by the "simultaneous method" with increasing doses of serum, changing from 20 to 25, 30, 35, and 40 c. c. The reaction to be desired should show a sharp rise of temperature, eyes slightly injected, loss of appetite, but no diarrhea. The work was complicated in a number of instances in the treatment of carabao, the animal not showing any rise of temperature, but developing a diarrhea and dying. This occurred several times, so that the inoculators drew the conclusion that an animal had a reaction when there was a marked injection of the eye with a diminution in appetite, but with no rise of temperature.

The dosage of serum was found to vary but little in the different parts of the islands, the average being 30 c. c.

The mortality percentages in the appended tables we believe to be somewhat misleading. In a number of instances the inoculators were unable to obtain the subsequent history of the animals after inoculation, and no doubt if they had been able to do so the death rate in certain localities would have been slightly increased.

In the provinces the opposition of the natives has been a great obstacle to the success of the work, not only from the trouble made in securing the animals, but also from the failure to bring them in for the taking of temperatures. This has made a great many of our records valueless, for it was impossible to tell whether or not the animals showed a proper reaction.

Another difficulty with which we have had to contend was inadequate transportation. The officials of the government have always given all the assistance which lay in their power, but as they themselves were encountering the same trouble it can be seen that but little assistance could be rendered.

The lack of trained inoculators confined the work to those districts in which rinderpest was epidemic. This explains why serum alone was given in so many cases. It is doubtful if the "simultaneous method" of inoculation is the best method to use in such infected localities, but the transportation was so irregular that it was deemed advisable if possible to bestow permanent immunity upon the animals instead of using the serum alone, the expectation being to return at some future date to complete the immunization. No doubt our mortality percentage has been increased over what it would have been had the work been done in clean localities, but we believe that what increase there may have been is more than counterbalanced by the amount of work which the inoculators were able to accomplish, as well as by doing away with the danger of allowing the temporary immunity to wear off and the animal so to contract the disease provided the inoculators could not return at the proper time.

In all the localities where the "simultaneous method" of inoculation has been used the epidemic has been brought to a rapid termination, only those animals which had been hidden by the natives subsequently contracting the disease.

Table No. 1 shows the amount of antirinderpest serum, in cubic centimeters, prepared and distributed during the period covered by the report.

TABLE NO. 1.—*Report of amount of rinderpest serum used in laboratory from January 1, 1903, to September 1, 1903.*

Month.	Prepared.	Returned.	Issued.	Balance.
	<i>c. c.</i>	<i>c. c.</i>	<i>c. c.</i>	<i>c. c.</i>
January.....	22, 838	.....	14, 238	.....
February.....	18, 794	.....	1, 000	.....
March.....	18, 610	.....	25, 130	.....
April.....	25, 528	.....	33, 322	.....
May.....	98, 900	.....	24, 940	.....
June.....	100, 400	.....	133, 725	.....
July.....	86, 008	58, 500	87, 100	.....
August.....	188, 550	50, 100	118, 608	.....
	559, 628	108, 600	438, 063	230, 165
Dropped				25, 104
				205, 061
Used at laboratory				27, 611
On hand September 1, 1903				177, 450

Table No. 2 shows the number of animals inoculated in the laboratory from January 1 to July 1, 1903, with the amount of serum and virulent blood used.

TABLE NO. 2.—*Report of the amount of rinderpest serum used at laboratory from January 1, 1903, to September 1, 1903, and amount of virulent blood for same period.*

Month.	Amount serum.	Number inoculations with serum.	Amount blood.	Number inoculations with blood.
January.....	3,245	68	5,992	70
February.....	1,595	31	10,225	56
March.....	5,269	63	19,851	74
April.....	3,520	106	10,074	117
May.....	4,525	50	24,460	75
June.....	1,200	26	24,316	79
July.....	2,860	44	76,862	124
August.....	2,890	68	52,523	112
	25,104	456	224,204	707
Blood.....				707
Serum.....				456
Total inoculations.....				1,163

It is impossible to state how many animals were bled to death in obtaining this amount of virulent blood, some of the records having become mixed with those of animals dying from other causes. The animals used for this purpose were small, the average amount of virulent blood obtained from an individual being about 4,500 c. c.

Table No. 3 shows the results of immunizing cattle and carabaos at the laboratory. This also includes animals which were supposed to have rinderpest and which were brought to the laboratory for treatment.

TABLE NO. 3.—*Method and result of immunizing cattle and carabao on admittance.*

Month.	Simultaneous method.		Serum method.		Treatment.	
	Number.	Deaths.	Number.	Deaths.	Number.	Deaths.
January.....	27	23				
February.....	4					
March.....	10	3	1		11	6
April.....	20		6			
May.....	11					
June.....	2					
July.....	2	1	11	2		
August.....	10	1	10	2		
Total.....	86	28	28	4	11	6

The death rate following the immunization of animals at the laboratory is greater than that obtained in the provinces. This can best be explained by the fact that nearly all the cattle brought to the laboratory for immunization were shipped from other ports, and as the majority of the ships are infected with rinderpest it was not difficult to predict what the results would be were the animals inoculated by the "simultaneous method," more especially when the animals are very probably in the incubative stages at the time of inoculation. The high mortality in January was due to the inoculation of a herd of carabaos imported from Borneo, which proved to be highly susceptible to the disease.

Table No. 4 shows the result of immunization of the vaccine calves and of the treatment given those which were sick at the time of arrival, as well as those inoculated with virulent blood for other purposes.

TABLE No. 4.—*Method and result of immunizing calves on admission.*

Month.	Simultaneous.		Serum.		Treatment.		Inoculated for virulent blood.	Deaths from other causes.
	Number.	Deaths.	Number.	Deaths.	Number.	Deaths.		
1903.								
January	19	1	7	.....	4	4	1	.....
February	10	2	23	.....	12	12	3	.....
March	5	2	29	1	12	12	1	.....
April	2	.....	25	.....	21	21	.....	1
May	2	.....	13	.....	5	5	2	.....
June .....	.....	.....	22	4	3	3	4	1
July .....	.....	.....	28	15	.....	.....	.....	.....
August .....	.....	.....	23	7	.....	.....	.....	.....
Total	38	5	171	27	57	57	11	4
Per cent .....	.....	13.15	.....	15.8	.....	100	.....	.....

All the calves coming under the heading of "Treatment" died. It may be stated, however, that a number of animals which were entered in the serum column which were but slightly attacked and received some treatment recovered. A large percentage of the animals were infected with both foot-and-mouth disease and rinderpest, and, as was stated above, this combination seems to be exceedingly fatal to both young and adult animals.

The treatment consisted in giving large doses of antirinderpest serum both subcutaneously and intravenously, with stimulation, but, as can be seen, the results were not encouraging.

Toward the latter part of the fiscal year the use of the "simultaneous method" with calves was almost discontinued, the majority receiving serum alone. This was done for reasons previously mentioned.

These animals subsequently subcutaneously received doses of virulent blood ranging from 5 to 20 c. c. in quantity sufficient to produce a reaction. The four dying during the month of June should not have been placed under this heading, as they showed elevated temperatures at the time of admission and developed foot-and-mouth disease the following day; they subsequently died of a combination of rinderpest and foot-and-mouth disease.

RINDERPEST INOCULATIONS IN THE PROVINCES.

On May 21, 1903, the Commission passed a law authorizing the board of health to employ 10 veterinary surgeons and 20 inoculators for the immunization against rinderpest of the cattle and carabaos of the Philippine Islands. The board of health have up to the present time been unable to obtain this number of employees capable of carrying on the work, there never having been more than two veterinary surgeons at work in the provinces at one time. The inoculators all took a course of instruction in this laboratory before being sent into the provinces. Their duties consisted principally in assisting at the inoculations, in taking temperatures, keeping the records of owners, etc. The majority of them were formerly hospital corps men of the United States Army and so did not require much training for the work.

Rinderpest having been reported at Surigao, on the island of Mindanao, Veterinary Surgeon John G. Slee and one assistant left for that port on February 1 with sufficient serum to inoculate 1,000 animals. Upon their arrival they found that rinderpest was not present at Surigao, but was said to be so farther south. An attempt was made to reach the afflicted district, but, owing to the season of the year and the nature of the coast, they were unable to go by water, and the impassable trails prevented them going overland, so they returned to Manila by the same boat, arriving February 10.

Upon receipt of a notice from the governor of Mindoro, stating that rinderpest was destroying a great many cattle and carabaos around Calapan, Veterinary Surg. John G. Slee, with one assistant, left Manila March 1, arriving at Calapan the following day. They found that rinderpest had killed a large number of cattle and carabaos in Calapan and its surrounding barrios, a number being sick at the time of their arrival. Difficult transportation confined the inoculations almost entirely to the immediate neighborhood of this town.

The first barrio visited was that of San Vicente, just across the river from Calapan. At this place, on March 3, 27 animals were inoculated by the "simultaneous method" and 6 with 50 c. c. of serum alone, because the latter seemed to have some of the symptoms of rinderpest. At the time of inoculation 10 animals were found to be suffering from the disease. On the following day Doctor Slee proceeded to Jolo, where 33 carabaos were treated by the "simultaneous method" and 5 with serum alone. A large number of animals had died in this place just previous to the arrival of the inoculators, and from the high mortality following the work it is probable that some animals were in the incubative stages at the time. The results of the inoculations will be noted in the appended table.

On March 29 Bulalo was visited, 39 carabaos inoculated by the "simultaneous method" and 1 with serum alone. Two of the former showed an elevation of temperature at the time of inoculation. Both subsequently died.

The next barrio was Baruyan. In this place 28 carabaos were treated, all by the "simultaneous method." Rinderpest was not present at the time of the visit, but a number of animals had died just previous to the arrival of the inoculators. The virulent blood employed at this place was a part of that used at Bulalo.

The barrio of Baco followed. At this place 38 animals were inoculated, 23 by the "simultaneous method" and 15 with serum alone. There was rinderpest present, a number of cattle showing either an injected eye or an elevated temperature. These were inoculated with 50 c. c. of serum each, no virulent blood being given. No transportation was available to the last-mentioned village, so the party was compelled to walk.

From Baco the inoculators proceeded to barrio Canubing. Considerable trouble was encountered here because of the unwillingness of the people to bring in the animals for inoculation, and after this was completed it was difficult to again see the animals for the purpose of taking temperatures, etc. Doctor Slee managed to inoculate 24 carabaos by the "simultaneous method" and 4 with 50 c. c. of serum alone. Rinderpest in this region is said to have first appeared in this barrio.

After completing the work at Baco, the party went to Bondoc, where 58 animals were inoculated by the "simultaneous method" and 3 with 50 c. c. each of serum. Rinderpest was also present in this place at the time of inoculation.

Suqui was next visited, rinderpest being present, and 33 carabaos were inoculated by the "simultaneous method."

After finishing at Suqui, a journey up the river brought them to Tanagan. At this place 60 animals were inoculated by the "simultaneous method." Rinderpest had not appeared in this locality at the time of the inoculation, and this probably accounts for the small percentage of deaths in this place.

Leaving Tanagan the veterinarians traveled on horseback to Siloney, where rinderpest was prevalent. At this place 21 animals were inoculated by the "simultaneous method" and 2 with 50 c. c. each of serum. Many difficulties were encountered on this trip, both from the prevalence of rinderpest and the opposition of the people.

Table No. 5 shows the results of the inoculations.

Eight of the animals inoculated by the "simultaneous method" showed some symptoms of rinderpest at the time of inoculation, and all of these subsequently died.

TABLE No. 5.

	Simultaneous method.		Serum.		Total.
	Number inoculated.	Deaths.	Number inoculated.	Deaths.	
San Vicente	27	2	6	1	33
Jolo	^a 38	8	.....	.....	38
Bulalo	^b 41	1	.....	1	42
Baruyan	28	4	.....	.....	28
Baco	23	7	15	1	38
Canubing	28	.....	1	1	29
Bondoc	^c 59	7	3	1	62
Suqui	33	2	.....	.....	33
Tanagan	60	1	.....	.....	60
Siloney	51	.....	2	.....	53
Total	388	37	28	5	416
Per cent	9.5				

^a Five animals showed symptoms at time of inoculation.

^b Two animals showed symptoms at time of inoculation.

^c One animal showed symptoms at time of inoculation.

Excluding these seven animals, the percentage of deaths by the simultaneous method was 7.44.

During the month of October, 1902, Veterinary Surg. John G. Slee and Asst. Director Charles S. Sly inoculated on the island of Tablas 20 carabaos by the "simultaneous method" and 70 with serum alone. At this time the opposition of the natives to the inoculations was very great. In one instance half of the animals were driven into the mountains to prevent their being seen by the veterinarians.

The success of this expedition was very marked. Those animals which had been inoculated by the "simultaneous method" passed through numerous subsequent epidemics without one becoming sick, while those inoculated with serum alone remained well for about five months, at the end of which time a number contracted rinderpest, although the natives noticed that these animals appeared to suffer from a milder type of the disease than those which had not been inoculated. During the five months following the inoculations by serum alone the latter passed through several epidemics.

On March 28, 1903, a communication was received from the governor of Romblon requesting that inoculators once more be sent to Tablas to inoculate the remaining animals in that district, it having been observed that nearly all the animals which had been driven into the mountains had died of rinderpest while those that had been inoculated by the "simultaneous method" were well.

On April 15, 1903, Veterinary Surg. Thomas M. Owens, with Chief Inoculator Albert M. Newby and three assistants, left for Romblon, arriving at Santa Fe, Tablas, on April 21.

On the day following, in a small barrio 5 miles from Santa Fe, 25 carabao were inoculated, and on the 22d 55 more, all by the "simultaneous method." The animals were under observation for ten days, temperatures being taken daily, morning and evening. Sixty-five per cent showed reactions, as demonstrated by rise of temperature, etc. The mortality can be seen in the accompanying table.

On April 25, 35 carabao 1 mile from Looc, Tablas, were treated, 20 by the "simultaneous method" and 14 by serum alone. All animals which received serum only showed some symptoms of the disease at the time of inoculation. On April 26 they inoculated 21 animals 4 miles from Looc, 15 being carabaos. Two received serum only, and 1 of these died. Nineteen were inoculated by the "simultaneous method." Six cows, although showing some symptoms of the disease, were inoculated by the "simultaneous method;" of these 2 died.

Between April 30 and May 4, 184 carabaos were inoculated, 137 by the "simultaneous method" and 47 with serum alone. The records of all these animals could not be obtained, as they were the property of many different owners from every section around Looc.

On May 5 Owen and Newby inoculated 77 animals 3 miles from Looc; 37 of these were carabaos, and received the "simultaneous method." Forty cattle which were badly infected were given serum alone. These cattle were very wild, and no record of the results of the inoculations could be obtained.

On May 14 the workers inoculated 301 animals in Alcantra, Tablas, 243 by the "simultaneous method" and 58 with serum only. Ninety-eight of these animals were cattle. The animals were under close observation for twelve days.

On May 16 they inoculated 28 animals in Ferrol, Tablas, by the "simultaneous method." The temperatures of these animals were recorded daily and excellent reactions noted.

Between June 8 and 17 470 animals were treated in Odiongan, Tablas. These animals were free from rinderpest, but they were given serum only, as virulent blood could not be obtained. The serum given on this occasion was of a different shipment, and the results were not as satisfactory as the shipments prior and since that time. Deaths from rinderpest were reported as occurring thirty-five days after inoculation. However, the disease has made no headway and has since disappeared from that locality.

No more animals were inoculated during the month of June, but several hundred have been treated since then with excellent results.

The mortality percentage is probably higher than the appended table shows, but as previously stated it was almost impossible in certain localities to obtain subsequent records of the inoculated animals.

Between July 4 and 14 70 carabaos were inoculated at Odiongan, 40 by the "simultaneous method," resulting in 1 death; 30 received serum only, and 6 of these died. A new shipment of serum was used on this occasion.

Between July 17 to August 5 136 carabaos were treated at Despujol, Tablas, 89 by the "simultaneous method;" 47 received serum only. No records were taken of these animals after August 9, as only a small per cent had been inoculated after August 1.

TABLE No. 6.—*Inoculations, island of Tablas, province of Romblon, by Doctor Owens and Mr. Newby.*

Date.	Simultaneous.		Serum.		Total.	
	Number.	Deaths.	Number.	Deaths.	Number.	Deaths.
Santa Fe, Apr. 22, 23	80	3	.....	.....	80	3
Looc, Apr. 24–May 8	214	.....	111	8	325	8
Alcantra, May 17–21	243	.....	58	.....	301	.....
Parrole, May 14	19	.....	9	.....	28	.....
Odiangan, June 8–July 11	41	1	499	27	540	28
Despujol, July 17–Aug. 5	89	.....	47	.....	136	.....
Total	686	4	724	35	1,410	39
Per cent.	0.51					

On April 25 a request was received from a representative of the General Tobacco Company requesting the government to send inoculators to Florida Blanca and Pagyuruan, a barrio of the former pueblo, Pampanga Province, the report being that the animals were dying very rapidly from rinderpest. It was stated that rinderpest first appeared about one month before a veterinarian was dispatched in a lot of 20 calves shipped from Manila, the disease subsequently spreading over that locality and killing a great many animals.

Veterinary Surg. Harry Dell, director of animal industry, bureau of agriculture, with one inoculator made the trip, and, as can be seen by the appended table, obtained very successful results. ^a They left Manila April 29 for Florida Blanca, arriving the same evening.

The first inoculating done was at San Pedro, a barrio of Florida Blanca, where 15 animals were inoculated by the "simultaneous method," and 7 others, showing symptoms of rinderpest, were treated with doses of serum varying from 50 to 80 c. c. each. On the following day the party proceeded to Pagyuruan, where they treated 58 by the "simultaneous method" and 6, which showed symptoms of rinderpest, with 50 c. c. each of serum (no virulent blood). On May 2 they returned to San Pedro and inoculated 216 by the "simultaneous method" and 3 with 50 c. c. of serum only.

The mortality in this lot of animals was smaller than that observed in any other series of inoculations by the "simultaneous method," and the results were closely watched.

Table No. 7 shows the results of the inoculations in Pampanga Province.

TABLE No. 7.—*Pampanga Province, Doctor Bell.*

Name.	Simultaneous method.		Serum.		Total inoculated.
	Number inoculated.	Deaths.	Number inoculated.	Deaths.	
San Pedro	15	0	7	5	22
Pagyuruan	58	0	6	1	64
San Pedro	216	1	3	2	219
Total	289	1	16	8	305
Per cent.	0.34				

Telegrams were received from the presidente of the provincial board of health of the province of Pangasinan, stating that rinderpest was killing a great many animals in that province, and requesting inoculators. On June 24, Chief Inoculator Albert Newby, with three assistants, left for Dagupan, arriving the same evening, reporting by telegraph to the governor of the province.

Investigation failed to show any rinderpest in that section of the province, and telegrams sent to different local presidentes showed that no rinderpest could be found; so, having no virulent blood with which to work, the party returned to Manila.

Word having been received from Doctor Sherman, of the chemical laboratory (who

^aThe thanks of the laboratory are due both to Doctor Bell and the chief of the bureau of agriculture, Prof. F. Lamson-Scribner, for their willing assistance in this work.

was at that time making a trip through the southern islands in search of gutta-percha), that rinderpest was prevalent in Zamboanga, Veterinary Surg. Harry Dell, with two inoculators, left June 24 on the U. S. Army transport *Seward*, arriving at their destination on the evening of the 29th.

After conferring with the military authorities it was deemed advisable to demonstrate the efficacy and harmlessness of this method of immunization upon the carabaos at the government farm at San Ramon.

At that time there was but 1 animal suffering from rinderpest, although 50 had already succumbed to the disease. The beast appearing to be nearly dead, it was necessary to bleed at once, which was done by the light of a single candle.

Returning to San Ramon the following day, all the animals—8 in number—were inoculated. After completing the work the party returned to Zamboanga, leaving one inoculator to take temperatures and note reactions. Sometime was then spent searching for sick animals in order to obtain virulent blood for other inoculations, but none were to be found. There were no deaths resulting from the inoculations at the San Ramon farm.

Finding that, from the inability to obtain virulent blood, he would be unable to do any more inoculating, Doctor Dell returned to Manila, arriving July 20.

Numerous telegrams having been received from the governor of Tarlac, stating the rinderpest was killing a large number of animals in that province and requesting that assistance be furnished, Dr. H. Dell, with three assistants, left for Tarlac on the morning of August 3, arriving the same evening.

Only 1 sick animal could be found and this had nearly recovered from the disease. Finding it to be impossible to obtain virulent blood in the neighborhood and believing that similar trouble would very likely arise in the future, it was decided to ship virulent blood to Doctor Dell from the laboratory. This was done not only to supply the inoculators with virulent blood, which they could not obtain in Tarlac, but also to serve as a basis for future work.

The results were not all that could be desired, as but a small percentage of the animals inoculated with the blood showed a reaction.

There was no ice chest on the train, which did not arrive in Tarlac until late in the evening, thus preventing any inoculations until the following day. This subjected the blood to conditions which would very rapidly destroy its virulency and is probably the reason why a higher percentage of reactions were not obtained.

On August 5, in Tarlac and its barrio, San Isidro, 62 carabaos were inoculated by the "simultaneous method," with no deaths resulting therefrom. On August 10, 69 animals were inoculated at Tibag by the "simultaneous method," using a second shipment of virulent blood. This lot of blood was subjected to the same conditions in shipment as the first, and the results following the inoculations were the same in both cases.

TABLE NO. 8.—*Inoculations, province of Tarlac, Doctor Dell.*

Number inoculated, simultaneous method:

Tarlac and San Isidro, August 5-8.....	62
Tibag, August 10-13	69
Total.....	131

The government having made a contract for the purchase of carabaos in Shanghai, for restocking the islands, which have been nearly depleted by rinderpest, Asst. Director Charles S. Sly was ordered to Shanghai to superintend the immunization of the animals against rinderpest. The immunization was done by Messrs. Keylock and Pratt, the contractors, who prepared their own serum.

Finding that the mortality following the inoculations was very high, orders were received to ship some Manila serum to Shanghai. The results obtained with the Manila serum is but little better than that obtained with the serum prepared in Shanghai, which is easily explained when the conditions under which the inoculations were undertaken are known. The animals are purchased 139 miles up the river and brought down in junks to Shanghai for immunization, being subjected to excessive heat during this time.

During the trip from 2 to 3 per cent die from the effects of overcrowding and exposure, while upon arrival about 1 per cent show symptoms of rinderpest. It will readily be seen that animals in this condition will not be able to withstand the reaction following the "simultaneous inoculation," and that under such circumstances a high death rate is to be expected. In striving to find the dose of serum which would give the smallest death rate, it was found that just as good results could be obtained with 40 c. c. as with 100 c. c., which makes it appear that other conditions were the main factors in producing the high mortality percentage.

Table No. 9 shows the results of animals inoculated in Shanghai up to July 16 with the Shanghai and Manila serum:

TABLE NO. 9.—*Inoculation government carabao, Shanghai, China, July 11 to July 18, 1903.*

KEYLOCK & PRATT SERUM.

Date.	Number inoculated.	Number deaths.	Total inoculated.	Total deaths.
June 11	73	.....	.....	.....
13	32	.....	.....	.....
14	11	.....	.....	.....
17	7	.....	.....	.....
21	6	.....	.....	.....
27	8	.....	.....	.....
Total.....	187	70	137	70

MANILA SERUM.

June 27	42	11	.....	.....
28	18	5	.....	.....
July 6	95	5	.....	.....
7	54	1	.....	.....
14	101	1	.....	.....
16	27	.....	.....	.....
Total	337	23	337	23
Total inoculated.....	.....	.....	474	.....
Total deaths .....	.....	.....	.....	93

A large number of animals have been inoculated since this date, but the reports are very incomplete, so will not be entered in the table. The mortality is about 40 per cent

Table No. 10 gives a summary of all provincial inoculations done from January 1 to September 1, 1903, and the results.

TABLE NO. 10.—*Summary of rinderpest inoculations in the provinces, January 1 to August 31, 1903.*

Place.	Simultaneous.		Serum.		Total.	
	Number.	Deaths.	Number.	Deaths.	Number.	Deaths.
Island of Mindoro	388	37	28	5	416	42
Island of Tablas	686	4	724	35	1,410	39
Province of Pampanga	289	1	16	8	305	9
Island of Mindanao .....	.....	.....	8	.....	8	.....
Province of Tarlac.....	131	.....	.....	.....	131	.....
Total.....	1,494	42	776	48	2,270	90
Per cent	2.8		6.1			

VACCINE VIRUS.

The preparation of vaccine virus in the Tropics is one of great difficulty, not only from the intense heat, which, unless great care is taken, will produce a marked decrease in the strength of the virus, but also from the large number of diseases with which we have to contend. The calves required were obtained in Hongkong, the majority of the cattle formerly on the islands having died from rinderpest.

The animals are shipped to Manila in lots of 20 to 25, and in nearly every instance upon arrival a number show rinderpest in its first stages.

It was the intention at first to immunize the calves by the "simultaneous method," but as so many of them develop the disease within one or two days after arrival this was discontinued, and all are inoculated upon their arrival with 50 c. c. of anti-rinderpest serum and later with sufficient virulent blood (10 to 20 c. c.) to obtain a reaction.

It has been noticed that nearly all the calves, even though appearing to be in the best of health, show an elevation of temperature, sometimes as high as 41° C., upon

arrival. Whether this is due to the exposure on the trip across the China Sea and to the change in water, food, and climate it is impossible to say, but it is sufficiently marked in nearly all that we are unable to use the animals for the preparation of the virus until they have been here for about ten days.

The method of immunization described above has been found to be the most successful. If the calf has been inoculated by the "simultaneous method" and a marked reaction obtained, it could not be vaccinated for about three weeks, but if it was given serum alone the high temperature noted above drops to normal in a few days, and in a week's time the animal could be safely vaccinated. By this method there was no necessity of waiting until it had recovered from the debility which very often follows inoculation by the "simultaneous method," and the mortality has been reduced to a minimum; nearly all the deaths occurring from rinderpest since this method has been in use have been in those animals showing the disease upon arrival or developing it one or two days afterwards.

A large number of the calves have foot-and-mouth disease upon arrival, and it is found necessary to put these in the quarantine stable for treatment. Very few animals die from this disease, and the ones which do apparently have been infected for some time.

No cases of tuberculosis have been observed in the calves purchased, and the city veterinarians inform me that they have never seen a case in the islands. This may partially be accounted for by the fact that the cattle are very seldom housed, being allowed to roam at will.

During the hot season it was found necessary to concentrate the virus which was to be used for vaccinating the calves and to decrease the area scarified to nearly one-half that feasible in the cooler months; but even with these alterations in technique the results while high temperature prevailed were not as good as could be desired.

Arrangements are being made whereby the vaccine stalls attached to the new laboratory can be kept cool in all seasons of the year. It is believed that this will not only prevent the shrinkage in yield, but will also tend to greatly increase the strength of the virus.

A series of experiments were undertaken to see if a new stock of vaccine virus could not be obtained from a case of smallpox. The experiments are not completed, but the results so far would lead me to think that new stock can be prepared by successive passages through monkeys.

A calf and monkey were vaccinated with lymph taken from three vesicles of a well-marked case of smallpox in the vesicular stage.

The calf never showed any local reaction that was observable.

The monkey showed nothing until the fourth day, at which time a slight induration was noticed in the vaccinated area. On the fifth day this was more apparent, but there were no signs of papules or vesicles. On the sixth day the induration was very marked, but still no papules or vesicles. A portion of the indurated area was removed on the eighth day and macerated with a 60 per cent solution of glycerin in water (virus "A 1"). There was no general eruption observable.

With virus "A 1," a calf and monkey were vaccinated. As in the preceding experiment the calf failed to show any local reaction.

Four days after the monkey was vaccinated there was noticeable a slight induration, becoming more marked during the following forty-eight hours, at which time there was noticed a few papules scattered over the vaccinated area and in the skin for several centimeters surrounding. During the following twenty-four hours these assumed a vesicular appearance, but were very small. The scarified area was markedly indurated. These vesicles were allowed to remain two days, and were then collected (virus "A 2") and the virus prepared as before. At the time of collection the vesicles were well filled and about the size of a grain of wheat. The induration was not so marked as in the first monkey. A few scattered vesicles were to be found 5 or 6 cm. from the margin of the vaccinated area. After collection there was seen to be a hard indurated mass, which, from the pressure used in collecting the virus, appeared to have become separated from the surrounding tissues. This mass was not removed at the time and there was no subsequent sloughing.

Virus "A 2" was used to vaccinate a monkey and calf. As in the preceding experiment the calf failed to show any local reaction.

The monkey after four days showed some induration over the vaccinated area. It was noticed in this case that the induration appeared earlier than in the preceding monkeys and was not so marked at any stage. On the sixth day distinct papules were noticed scattered over the vaccinated area. These papules were larger and somewhat more numerous than those noticed on the preceding monkey. Two days later these had developed into vesicles which were larger than those previously seen with this strain of virus. The virus ("A 3") was collected on the eighth day and prepared as usual.

Virus "A 3" was used to vaccinate a calf and monkey. In this calf there appeared to be a thickening of the skin on the fifth day, but nothing very distinct, and if such changes were present they disappeared very rapidly.

The monkey showed numerous papules scattered over the vaccinated area on the fourth day. The induration was slight as compared with the previous one. By the sixth day the vesicles were fairly thick, although small. The virus "A 4" was collected on the eighth day, at which time the vesicles were much larger than those previously seen.

Virus "A 4" was used to vaccinate a calf and a monkey.

This calf was vaccinated by two methods, viz, first, a scarification was made along one side of the linea-alba and the virus rubbed in; second, with a hypodermic needle filled with the virus; very superficial punctures were made and a small amount of the virus forced into the deeper layers of the skin.

Some induration was noticeable on the third day, and on the following day a few papules were to be seen scattered over the sites of the inoculations. By the fifth day these had developed into well-marked vesicles. The vesicles were unevenly distributed over the vaccinated area, and there was considerable swelling in the spots where the virus had been injected with the hypodermic needle; these afterwards terminated in abscesses.

The virus "A 6" was collected from the scarification on the sixth day. At the time of collection the vesicles were well filled and about the size of a bean. On the following day the virus over the "insertion area" was collected. These vesicles were considerably larger than those seen on the scarified area, although on the day previous they appeared smaller.

The monkey vaccinated with virus "A 4" presented about the same appearance as the one from which virus "A 4" was obtained, with the exception that the vesicles were more numerous. The virus "A 5" was collected on the eighth day and prepared as usual.

Virus "A6" was used to vaccinate a calf and monkey, and in both animals the results were indistinguishable from those obtained with the regular vaccine virus.

As can be seen from this series of experiments, no results were obtained by vaccinating calves with smallpox until it had been passed through four monkeys. The calf vaccinated with virus which had been passed through four monkeys gave only fair results, but the virus then obtained gave excellent results when subsequently used upon other calves, in fact gives larger vesicles.

This virus was tried on employees of the laboratory, but as all showed scars following previous successful vaccinations no results were to be expected. It has not yet been tried for first vaccinations. In vaccinating a calf the following method is used: The part beginning about the level of the tenth rib and to the perineum, and extending about 30 cm. either side of the median line, is first thoroughly scrubbed with soap and water and shaved. After shaving it is again scrubbed with soap and water, rubbing with the hands only. The surface is then sterilized with a 3 per cent solution of carbolic acid, alcohol, and water used in the order named, care being taken that all the acid and alcohol are removed with sterile distilled water. The parts are covered with sterile gauze until the operation begins.

Beginning about 15 to 20 cm. above the umbilicus and 6 to 10 cm. to the outer side of the median line, longitudinal scarifications are made extending into the perineum. The virus is then rubbed in with a sterile brush, after which the surface is further scarified by making lines perpendicular to the first.

If the calf is large two series may be made on the same side. After scarification the parts are covered by sterile gauze, the gauze being kept in place by an abdominal bandage having bands which fasten over the back. If a male calf the gauze should be changed twice a day, or as often as soiled.

The virus is collected when the vesicle is "ripe," generally about the fourth or fifth day.

In collecting the virus the abdomen is first washed with warm, sterile distilled water until the parts are thoroughly softened. It is then washed with a soap solution, gently rubbing with a soft brush to remove the desquamated epithelium. After this a 3 per cent solution of carbolic acid is allowed to flow over the parts, this being removed with sterile distilled water. The virus is then collected and put in a previously weighed sterile Petri dish and again reweighed.

The virus is then passed and repassed through a vaccine mixer and, as it becomes more finely macerated, four times its weight of a solution containing 60 per cent of glycerin is added very gradually until the whole is thoroughly mixed. To test it a platinum loop full of the mixture is added to a test-tube containing about 20 c. c. of distilled water and thoroughly shaken; if any large particles are to be seen after thoroughly shaking, it should be repassed through the machine and again retested.

The virus is then drawn up into sterile capillary tubes and the ends sealed in a flame or placed in sterile vials holding 100 doses each.

Table No. 11 shows the number of calves bought, calves vaccinated, number from which virus was collected, and the number of doses prepared during the period covered by this report.

TABLE NO. 11.—*Calves bought and vaccinated and vaccine prepared and issued.*

Month.	Bought.	Vaccinated.	Collected from—	Prepared.	Issued board of health.	Issued laboratory.
January.....	12	19	17	144, 888	145, 825	3, 800
February.....	49	27	22	202, 410	158, 805	5, 400
March.....	52	39	24	93, 700	122, 645	7, 800
April.....	57	30	33	839, 700	240, 600	6, 000
May.....	0	9	5	20, 300	100, 000	1, 800
June.....	25	27	23	32, 000	49, 000	5, 400
July.....	27	36	31	100, 900	79, 800	7, 200
August.....	α 24	12	9	49, 400	43, 280	2, 400
Total.....	246	199	164	983, 298	939, 955	39, 800

α In the month of August, 18 vaccine calves were traded for new ones.

To board of health.....	939, 955
To serum laboratory.....	39, 800
	<hr/>
	979, 755
Prepared.....	983, 298
	<hr/>
Balance.....	3, 543

It will be noticed that there is quite a discrepancy between the number of calves vaccinated and the number from which the virus was collected. This was caused by the appearance of foot-and-mouth disease among the calves after they had been vaccinated; also in a few instances by the development of rinderpest.

PLAGUE PROPHYLACTIC.

The preparation of a plague prophylactic was begun during the year 1902. It was the intention at that time to prepare Haffkeine's prophylactic, but the board of health, learning that the Indian government was having considerable trouble as a result of some very severe local reactions, decided that it would be preferable to use some other prophylactic which would not cause this trouble. For this reason "Shiga's method" of preparing plague prophylactic was used instead.

A fresh culture obtained by passage through a guinea-pig or monkey was used. The culture media consisted of ordinary agar in test tubes 25 mm. in diameter. In making cultures, a heavy platinum wire, the end of which is wound into a flat coil about 15 to 18 mm. in diameter, is used. The cultures were allowed to remain in the incubator for forty-eight hours, at a temperature of about 32° C.

The bacilli were scraped off the agar at the end of this time by means of a large flattened platinum wire, the end of which had been bent at right angles. The bacilli were transferred to a glass mortar which had previously been sterilized for two to three hours at a temperature of about 180° C. Before sterilizing, the mortar was accurately weighed and again reweighed after the addition of the bacilli. To overcome any error in calculation due to agar being present with the bacilli when it was reweighed, the following steps were taken: Two sterile flasks, one empty and the other filled with a 0.9 per cent solution of sodium chloride, are accurately weighed. Then with a sterile pestle the saline solution is gradually and thoroughly mixed with the bacilli until the glutinous appearance has disappeared and an even emulsion has been formed. This is then passed through a very fine meshed wire strainer (to remove all the agar) and into the sterile empty flasks, care being taken to remove all the bacilli by means of fresh saline solution. Both flasks are then reweighed. The difference in weight of the flask originally containing the solution shows the amount added to the bacilli and now in the other flask. The difference in weight of the other flask, above that of the solution added, shows the actual weight of the bacilli present.

After finding the amount of the bacilli present the flask is placed in a water bath, and the water brought to a temperature of 60° C. and held at that temperature for thirty minutes.

After sterilization, the weight of the bacilli being known, the amount of sodium chloride solution required to be added so that 1 c. c. shall contain 0.006 gram is then found, 10 per cent is deducted, and this is replaced by a 5 per cent solution of carbofic acid.

After preparation and before distribution, cultures are made and one or more animals are inoculated to make sure that the prophylactic is sterile.

Table No. 12 shows the amount of the prophylactic prepared and the amount delivered to the board of health from January 1 to September 1, 1903.

TABLE NO. 12.—*Plague prophylactic.*

Month.	Number cubic centimeters prepared.	Amount distributed.	Balance.
February	1,514	350	.....
March	7,160	390	.....
April		1,440	.....
May	8,604	15,100	.....
June	7,128	6,520	.....
July	16,920	7,556	.....
Total	41,326	31,956	9,370

This prophylactic has been used almost entirely for the inoculation of the Chinese in the city of Manila. Heretofore the Chinese population has furnished about 60 per cent of the total number of plague cases, but since the inoculating has been in force the percentage has rapidly decreased.

According to the board of health reports, no case has occurred in those who have been inoculated twice, and but very few in those who have been inoculated once. In several instances where a house was occupied by a number of persons and all were inoculated but one, the noninoculated person contracted the disease, while those remaining, though probably subjected to the same exposure as this case and being in contact with it until found by the board of health, were not affected.

No cases have been reported in which there have been any bad results following the inoculations, either local or general in character.

ANTIPLAGUE SERUM.

Very little has been done toward the production of this serum. While we have four horses on hand at present for its production, the large amount of work caused by the increased demand for vaccine virus, the preparation of antirinderpest serum and plague prophylactic has taken the entire time of the small force at the laboratory.

Three methods are now being used for the preparation of this serum: First, inoculating the horse with the sterile bacilli in gradually increasing doses, until 7 grams are given at one time, the horse then being bled in the usual manner; second, inoculating with a sterile thirty days' old bouillon culture in gradually increasing doses; third, with the nucleo-proteid after Lustig's method.

Only one horse has been bled and this one had been immunized with the sterile bacilli. This animal was bled May 25, and the serum tested as usual. The serum has not yet been used in sufficient quantity to make any statement as to its efficiency.

EXHIBIT B.

REPORT OF THE CHEMICAL LABORATORY, PREPARED BY DR. P. L. SHERMAN, CHEMIST.

The details of the routine work done by the chemical laboratory during the past year are given in the accompanying tables, which show the diversity of analyses undertaken as well as the number of departments of the Government which have taken advantage of the opportunity offered by it. There is no private assay office nor general analytical laboratory in the Philippines, and consequently the Commission authorized the bureau, by resolution dated December 1, 1902, to undertake custom analyses at a price covering the cost of material and work expended. As might be expected, the majority of the analyses thus undertaken were of ores and natural products, the values of which it was desired to know. Next in importance came

physiological work for the practicing physicians of the city. Facilities for the latter are most necessary, as few physicians here are in a position to do this work themselves. The use of benzoyl-acetyl hyperoxide continued in Manila, more especially on demand from the board of health, which used large quantities in San Lazaro Hospital. The results of the work in that institution will be given in the special report of the board of health. Table No. 1 shows the amount of acetozone distributed, Table No. 2, the routine work of the laboratory.

TABLE No. 1.—*Acetozone.*

Month.	Board of health.			Private parties.	
	Crystals, grams.	Capsules.	Solution L. (1-1000).	Capsules.	Solution L. (1-1000).
August.....		800	600		
September.....	695	717			
October.....	500	405			
November.....	505	315			
December.....	750				
January.....	735	210			
February.....	600	235			
March.....	900		120	30	
April.....	1,100				
May.....	750			89	140
June.....	890				
July.....	750			89	101
August.....	1,100			276	
Total.....	9,275	2,682	720	484	241

TABLE No. 2.

	Attorney-general.	Board of health.	Bureau of agriculture.	Bureau government laboratories.	Bureau non-Christian tribes (ethnological survey).	Civil hospital.	Consulting engineer.	Custom-house.	Exposition board.	Forestry bureau.	Insular purchasing agent.	Insular treasurer.	Mining bureau.
Alcohols.....													
Assays.....				3					73				
Beverages.....		10											
Celluloid.....											1		
Coals.....				3									
Coins.....								8				2	
Criminal (not poison).....													
Disinfectants.....		3		1				2					
Feeds.....			1										
Flavoring extracts.....								1					
Food products.....		9			3			4					
Fertilizers.....			3										
Gravels.....							2						
Gums, resins, etc.....			2	2						2			
Human milk.....													
Lubricants.....											1		
Metals and alloys.....								21					
Medicines.....	9			12		1		1					
Minerals.....		1		3	1		3		5				4
Oils.....											2		
Paints.....								22					
Pathological.....						6							
Petroleum.....											2		
Perfumes.....													
Poisons.....	2	6				4							
Protective coating.....													
Seeds.....			2	2									
Soap.....		2											
Soils.....			8										
Textiles.....								7					
Urinés.....		9		1		276							
Waters:													
Mineral.....		8											1
Potable.....		1				1	13						
Total.....	2	58	16	27	4	288	18	66	78	2	6	2	5

TABLE No. 2—Acetozone—Continued.

	Miscellaneous.	Private.	Prosecuting attorney.	Secretary of the interior.	United States Army.	Secret service.	Philippine constabulary.	Cold storage.	Bureau of architecture.	Bilibid prison.	Municipal board.	Total.
Alcohols	1	7										8
Assays		71		3								150
Beverages												10
Celluloid												1
Coals		5		1	2							11
Coins												10
Criminal (not poison)			1			1						2
Disinfectants												6
Feeds							1					2
Flavoring extracts												1
Food products		2										18
Fertilizers												3
Gravels												2
Gums, resins, etc.												6
Human milk		2										2
Lubricants								1				2
Metals and alloys		1										22
Medicines					2							25
Minerals				1								14
Oils		1										7
Paints									1			23
Pathological										1		7
Petroleum		2										4
Perfumes		3										3
Poisons		1	2									15
Protective coating									2			2
Seeds												4
Soap												2
Soils												8
Textiles												7
Urine		68										354
Waters:												
Mineral				4	3							16
Potable					1						1	17
Total	1	163	3	9	8	1	1	1	3	1	1	764

Although the above shows the amount of routine undertaken, it does not touch upon other important work now in progress, and begun with the object of systematically examining, analyzing, and describing the raw products and undeveloped resources of the islands. Owing to the heavy demands upon the time of the chemists made by analytical work, but one subject—the Gutta-Percha and Rubber of the Philippine Islands—has been completed sufficiently to justify publication. The others, however, are well under way, and the amount accomplished is given below. The completed researches will be published during the coming year.

The principal subjects now under investigation are:

THE MINERAL RESOURCES.

Considerable material available for preparing a systematic report on the value of Philippine ores, based upon actual assays and analyses, has been collected during the past year and in large part worked up. While some of this material on the mineral resources has been furnished by private parties, most of it was collected by the agents of the St. Louis Exposition Board for exhibition purposes. The collection was made so as to be as comprehensive as possible and to illustrate the distribution of economic minerals in the islands, yet it must be borne in mind that the Philippines contain no mines at the present time which are really in working condition, and the samples, or more often specimens, were generally collected from surface indications and outcroppings, from small native workings, old abandoned shafts, and in fact from the best places available where systematic prospecting is still lacking and even explosives unobtainable.

Bearing in mind that the great backbone of the Philippines, from Luzon in the north through all of the principal islands to Mindanao in the south, presents a great variety of minerals throughout almost its entire length, the work now in progress at the laboratory is being planned with a view of systematically collecting, analyzing,

and classifying the minerals of the various provinces and islands from one end of the Archipelago to the other. This work will be greatly aided in the future by topographic and geologic surveys. At present the specimens collected from the various regions considered most promising are most useful in indicating the diversity of the work outlined, and also to some extent to show the fortune attending the prospectors and miners.

The mineralogical products so far collected are, in brief, as follows:

COAL.

The coal reported is all of the black and brown lignite variety, the best black specimens having a heating capacity of two-thirds to three-fourths of that of Cardiff coal. None are coaking, except one from central Luzon, but as nearly all specimens obtained were badly weathered, due allowance must be made. The sulphur content is small and moisture high. Samples were taken from Abra, Bataan, Bulacan, Morong, Rizal, Cagayan, and Payabas, in Luzon, and the islands of Marinduque, Mindoro, Mindanao, Cebu, Masbate, Panay, Bataan, Samar, and Negros. The black lignites from Cebu, Bataan, and Negros are apparently the best. The government is now investigating the Bataan Island coal deposits, and good samples taken at a depth will aid much in determining the real value of Philippine coal, and in all such expeditions it is of the greatest importance that the laboratory be furnished with good samples of all materials collected, together with data as to their location and the conditions under which they are obtained. The following table, No. 3, gives the analyses made at this bureau during the past year and shows the comparative merits of the respective classes:

TABLE NO. 3.—*Coal analyses, bureau of government laboratories, 1902-3.*

Locality.	Water.	Volatile compound matter.	Fixed Carbon.	Ash.	Iron.	Sulphur.	Phosphorus.
Philippine lignites	18.50	37.73	38.10	5.66	0.48	0.87	.....
Alpaco, Cebu	5.00	42.21	49.70	3.08	.52	.22	0.05
Danao, Cebu	13.35	42.20	43.73	.71	.....	.....	.....
Compostela, Cebu	8.96	35.11	52.92	3.00	.....	.....	.....
Mount Uling, Cebu	8.83	35.10	52.78	3.28	.....	.....	.....
Do	9.30	39.24	48.64	2.81	.....	.....	.....
Zamboanga, Mindanao	17.30	44.51	34.67	3.52	.....	.....	.....
Surigao, Mindanao	4.64	38.38	55.19	1.78	.....	.....	.....
Montalban	17.37	41.80	33.44	7.38	.....	.....	.....
Western Negros	1.75	38.19	47.87	12.18	.....	.....	.....
Calatrava, Negros	21.20	40.80	31.50	6.50	.....	.....	.....
Kabanklan, Negros	19.33	32.37	39.91	8.39	.....	.....	.....
Japanese coal	15.03	33.50	44.67	6.79	.....	.....	.....
Do	2.38	38.27	52.58	6.77	.33	.21	.32
Do	2.10	38.10	45.90	13.90	.....	.....	.....
Australian coal	1.71	25.53	67.06	5.70	.42	1.07	.14
Do	2.00	32.60	56.60	8.80	.....	.....	.....
Do	2.47	32.15	59.20	7.17	.24	.22	.66

GOLD.

The gold ores are quartz, generally decomposed and iron stained when taken from the surface, and pyritic when taken at even small depths under ground. Benguet as a rule has less sulphur in its ores than Lepanto. The former appears free milling, while the latter are refractory. The gold values from the assays made, range from nothing up to \$120 a ton. About one-half showed no value, while the other half averaged less than \$5 a ton.

Gold-bearing quartz has been collected from Cagayan, Bontoc, Lepanto, Benguet, Rizal, Batangas, Laguna, Bataan, Pangasinan and the Camarines in Luzon, and Panay, Masbate, Mindoro and Mindanao. It is also reported from many other islands.

COPPER.

The majority of the samples received were of sulphides, while the rest was composed of metallic copper (Lepanto and Masbate), malachite (Benguet), and chalcoppyrite (Mindoro, Cagayan). A sample of copper glance from Lepanto assayed 80 per cent copper, and many others were also of high value. One large deposit in Benguet assayed 18 per cent copper.

SILVER.

Although found in all gold and many copper ores, it has so far not been found in paying quantities.

IRON.

Samples were received from many localities and in many islands, those from the large deposit at Angat, Bulacan province, proving the best. It is a pure hematite, and adapted to steel reduction.

LEAD.

Very fair specimens of the sulphide from Bontoc (Luzon) and Cebu have been received.

SULPHUR.

Specimens are at hand from Bontoc, Cagayan, Negros, Albay, Batangas, and the island of Biliran.

LIMESTONE.

The best marble probably comes from the island of Romblon, though present also in many other localities. Limestone for building and for the manufacture of lime is widely extended over Luzon and the islands of Panay and Mindanao. Coral limestone abounds on the islands of the southern Philippines and Mindoro.

SALT.

No deposits of rock salt have so far been reported, but salt springs are found in Bontoc, Ilocos Norte and Sur, Nueva Viscaya, Union in Luzon, and on the islands of Marinduque, Paragua, Bohol, Negros, Panay, and Samar.

CLAYS.

Some good kaolin and several varieties of clay samples have been collected from many localities. They include both red and white varieties.

MISCELLANEOUS.

Metals of platinum group.—Some eight samples have been examined, but so far no trace has been found of these metals. Platinum is reported, on good authority, from the Rio Grande Valley, Mindanao.

Basalt is reported from Rizal (Luzon); Tufa in large quantities is found in the vicinity of Manila, Laguna, and Batangas. It is the principal building stone used in Manila. Sandstone, from Panay and Balabac; charcoal, from Catubig (Samar); stalactites, from Capiz (Panay); stalagmites, from Bontoc; gneiss, from Camarines Norte; diorite, from Camarines and Rizal; porphyry, from Lepanto.

MINERAL WATERS.

The following table, No. 4, gives the composition of the waters from various parts of the islands analyzed at the laboratory during the past year. As will be seen, only two of the samples called mineral waters really showed total solids in sufficient quantity to warrant the name. A more extended investigation is necessary to discover if any valuable medicinal waters are found in the islands.

TABLE NO. 4.—Analyses of mineral waters, bureau of government laboratories, 1902-3.

Locality.	Total residue.	Fixed residue.	Free ammonia (NH ₃).	Iron oxide (Fe ₂ O ₃).	Alumina (Al ₂ O ₃).	Calcium (CaO).	Magnesium (MgO).
Saline waters:							
San Miguel, Camarines.....	414.00	308.00	.....	1.98	0.46	64.60	85.80
Bued River, Benguet.....	450.00	366.00	Trace.	3.83	7.06	61.20	35.40
Benguet.....	320.00	.....	.....	.....	.....	71.90	4.90
	1,447.00	.....	.....	.....	.....	197.00	4.30
	347.00	.....	.....	.....	.....	109.00	20.90
	563.00	.....	.....	.....	.....	141.40	17.30
Twin Peaks, Benguet.....	294.00	.....	.....	.....	.....	71.10	7.10
	271.00	.....	.....	.....	.....	87.00	5.50
Sulphureted waters:							
Bued River, Benguet.....	1,556.00	.....	.....	.....	.....	180.00	3.20
Twin Peaks, Benguet.....	355.00	.....	.....	.....	.....	101.00	3.60
	340.00	.....	.....	.....	.....	85.70	11.90
Table water, Bued River, Benguet....	49.30	30.00	Trace.	.....	.....	Trace.	(a)

Locality.	Sodium (Na ₂ O).	Chlorine (Cl).	Silica (SiO ₂).	Sulphuric acid (H ₂ SO ₄).	Carbonic acid (CO ₂).	Hydrogen sulphide (H ₂ S).
Saline waters:						
San Miguel, Camarines	63.20	17.70	128.20	.....	(a)	.....
Bued River, Benguet	40.50	17.70	128.40	.....	(a)	.....
Benguet .....	.....	1,038.00	.....	.....	.....	2.07
	.....	Trace.	.....	.....	.....	.65
	.....	Trace.	.....	.....	.....	.96
Twin Peaks, Benguet.....	.....	.....	.....	.....	.....	4.67
Sulphureted waters:						
Bued River, Benguet .....	.....	460.00	.....	.....	.....	b 12.10
Twin Peaks, Benguet.....	.....	Trace.	.....	.....	.....	b 17.40
	.....	.....	.....	.....	.....	b 7.32
Table water, Bued River, Benguet .....	.....	Trace.	(a)	7.97	Trace.	.....

a Small amount.

b Cubic centimeters per liter.

NOTE.—All figures are in parts per million.

RESINS, GUMS, AND WOOD OILS.

In a large number of places throughout the islands from Luzon to Mindanao and Paragua quantities of resins (breas) have been taken for many years, and the supply is far from being exhausted. Most of this is the gum copal of commerce, though some is reported under the name of dammar gum. The laboratory is now analyzing this and other resins, some of which contain a large percentage of essential oils. To this latter class belong the "breas" or Pili gum, which is collected from forest trees of the genus *Canarium*. A gum similar to the gum chicle of Yucatan has been found in several islands and is now being worked up with the view of ascertaining its commercial value. It probably comes from a species of *Ficus*.

Panao (wood) oil is being exported to some extent for use as varnish oil. The experiments now under way show it to be composed of an essential oil and a large amount of a soft resin. A sample of manapo oil has been received from Baler, province of Principe, which is peculiar in that it contains an apparently unknown essential oil in combination with a white crystalline resin.

Through the exposition board samples of several hitherto unreported resins and two gums have been collected, and their analysis is now under way. The gums are water soluble and resemble gum senegal somewhat, while the resins are of various colors and all apparently contain aromatic oils. The "breas" have received the greatest attention, and so far, two distinct varieties of white "brea" have come to the laboratory. They differ markedly in that one from *Canarium luzoniense* contains 21.18 per cent of pure pinene, while the other, the usual brea of commerce, contains 9.3 per cent of phellandrene. The results of the present investigations on the gums and resins will be published as a bulletin as soon as they are completed sufficiently to warrant publication.

COPRA AND COCOANUTS.

The copra and coconut industry is practically second to none in the islands, and the laboratory is now engaged in analyzing large numbers of nuts of all ages and the dried copra from many localities. The various samples are being worked over into

copra and the percentage of oil, water, and cake determined. So far the work has shown great variation in nuts from different localities and even from the same tree. The quantitative analyses will be graphically displayed at the St. Louis Exposition. It is hoped that the analyses will shed some light on the question of the benefit or harm of sea air and water on the yield and value of cocoanut trees, as well as the variations in oil-producing capacities between different regions.

TAN BARKS AND DYEWOODS.

In connection with the forestry bureau the laboratory is now investigating some 200 specimens of this class of forest products collected in Luzon and Mindoro. Although some apparently good colors have already been extracted, it is too soon to give an opinion as to their real value. Some of the tan barks are rich in tanning principle.

SOILS.

In connection with the bureau of agriculture, the systematic analysis of soils from the various agricultural centers for tobacco, coffee, rice, hemp, cacao, cocoanuts, etc., has been undertaken. So far samples of soils have been received from several of the government experimental farms and analyses made. The work of soil analysis while in itself giving the composition of individual soils, has not the comprehensive scope which would be given by a geologic survey.

GUTTA-PERCHA AND RUBBER.

The material for this report was collected under the direction of both the bureaus of forestry and government laboratories. As early as 1900 the attention of the government was called to the fact that many of the wild tribes in the southern islands were engaged in cutting down large numbers of forest trees in order to secure the gutta-percha and rubber which they contained. These products they bartered to the Chinese, who in turn exported them to Singapore.

The matter was considered important enough to demand investigation, because—

1. The trees were being cut down in violation of forestry rules.
2. No forestry dues were paid by those either collecting or exporting these forest products.
3. Judging from the experience of the English and Dutch in the Malay Peninsula, Sumatra, and Borneo, it would only be a question of a short time, if the wild tribes were allowed to have their own way, when there would not be one tree of this class left standing in the Philippines.

Unfortunately there was no information at hand on the subject. In June, 1901, I was sent as a special agent of the forestry bureau to Singapore, the Malay Federated States, and Java to study the laws and conditions there under which these forest products were grown, collected, and marketed.

Provided with the information thus gathered, and which is detailed below, upon my return to Manila, four months later, I was again sent to the southern Philippines to repeat my investigations, and as before to make collections of herbarium material and samples of the various kinds and grades of gutta-percha and rubber found there.

This first southern trip consumed several months, for while specimens of marketable gutta-percha and rubber could be secured in the principal towns, all herbarium material and gums from each tree species had to be taken personally to avoid all sources of error.

The trips along the coasts and rivers of many of the islands were made in small native sail and row boats, and the journeys into the forests of the interior were done on foot with native guides and carriers. The native gum collectors themselves, their method of felling the trees and vines, securing the gutta-percha and rubber, preparing the same for market, the prices they received both in money and barter, were thus seen at first hand, and of course opportunity secured for making herbarium collections of the various species of trees and vines yielding gutta-percha and rubber. In the principal towns the market conditions of supply, demand, prices, etc., were studied.

Upon my return to Manila I was ordered transferred to the bureau of government laboratories, in order that all specimens collected might be tested chemically and physically so as to determine their relative values. This analytical work, as well as several subsequent trips to the southern islands, Paragua, Mindoro, and Cullion, in search of new material, has been carried out and is here reported.

The identification of the various species of gutta-percha and rubber trees and vines was kindly undertaken by Mr. E. D. Merrill, botanist for the bureau, who also assisted greatly in collecting herbarium material in Mindoro and Cullion.

PART I.—GUTTA-PERCHA.

HISTORICAL.

Like many other commercial products coming from oriental lands, the date of the discovery of gutta-percha is lost in oriental history. The famous Tradescant Brothers, in 1666, exhibited in their museum of curiosities, in London, a piece of gutta-percha which they had secured in the Far East. Also in 1842, Dr. William Montgomery, an English surgeon, saw whips and other articles of gutta-percha in use by the natives of Singapore. It is therefore safe to assume that the real discovery of this remarkable substance was made at some time previous to either of these dates.

The western, or commercial, discovery of gutta-percha was delayed until 1843, when both Doctors Montgomery and D'Almeida sent specimens of the gums and leaves of the tree to London. While the specimens of D'Almeida were neglected, those of Montgomery received enough attention from the scientists of the Royal Society of Arts to demonstrate some of the uses to which the substance might be put. The botanists agreed that the tree belonged to the family Sapotaceæ, but as neither flowers or fruit were at hand they could go no further with the identification.

In 1847 the greatest advance was made toward the utilization of gutta-percha. Considerable amounts had from time to time been shipped to London, and experiments were made to determine its physical and chemical characteristics. Luckily a sample fell into the hands of a young German artillery lieutenant, Werner von Siemens, who was then experimenting with insulating material for subterranean and submarine telegraphic cables. The ease with which gutta-percha lent itself to this object, and the high efficiency obtained, induced him to construct a machine for insulating cables. The method he adopted, as well as the kind of machinery, has, with few modifications, been in use ever since then.

The subsequent history of gutta-percha runs parallel with that of submarine and subterranean electric cables, for three-fourths of all the gutta-percha produced has been used on them. With the construction of the great trans-Atlantic cables in the sixties and seventies of the past century, the demand for gutta-percha became enormous, and the details of its value and ready market traveled all over this part of the Orient.

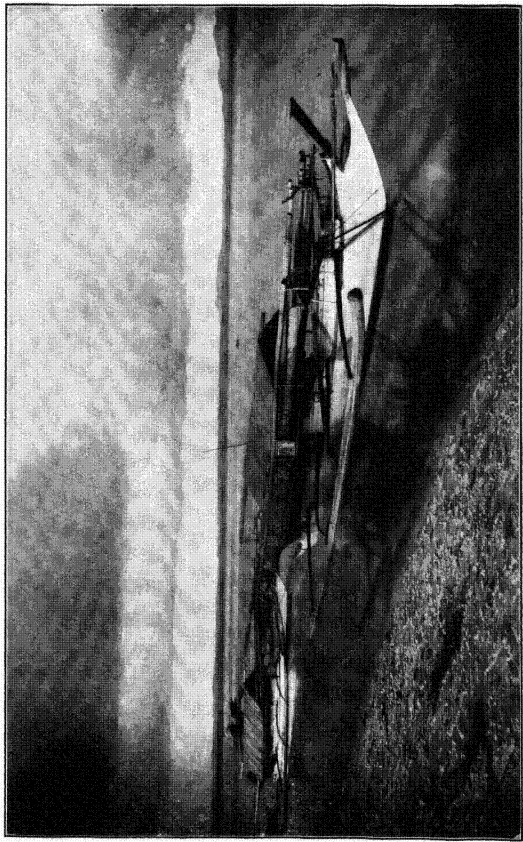
When the Malay Peninsula, adjacent to Singapore, failed to supply sufficient quantities to meet the demand, the nearby islands of the Rhio Archipelago and Sumatra were invaded, and rich finds made. Finally Borneo was included in the producing zone and lastly the Philippines.

At what date the Philippines began to export gutta-percha to Singapore, the center of the gutta-percha trade, can not be learned with any degree of certainty. Probably twenty years ago varying quantities were exported, but apparently the trade died out, owing, it is said, to the wholesale adulterations practiced by the Chinese exporters and the prohibitory laws of the Spanish Government. For the last ten years prior to the American occupation of the islands but little had been exported, though the collecting and exporting began very soon afterwards and increased at once to large proportions.

BOTANICAL.

In the year in which Von Siemens made his great discovery of the insulating value of gutta-percha for submarine cables, Sir Joseph Hooker, Bentham, and others worked out the status of the gutta-percha tree. From the first specimen of leaves which had been sent to England several years previously it was seen that it belonged to the natural family of Sapotaceæ. The many species of this family are scattered over the tropical and semitropical world, and are distinguished by the curious property they all possess of secreting a milk or latex in the inner layers of the bark. When the bark is cut or bruised and the capillary sacks and tubes, which contain the latex, are ruptured, it flows out with greater or less abundance, according to the species of the tree. What part this secreted milk plays in the plant economy has not yet been determined, but the essential fact has been established that this product is discarded by the tree in its dead leaves and bark, and that the bark of the live tree can be tapped and the latex removed with no apparent injury to the tree.

As has been stated, it was in 1847 that specimens of the flowers and fruit finally reached London and the complete botanical determination of them made, which resulted in giving to the tree the name of *Dichopsis gutta* Benth. et Hook., fls. A few years later the Dutch botanist Burek pointed out the fact that as early as 1837 Padre Blanco had given the name of paladium to this genus of Sapotaceæ, and accordingly most botanists have adopted the name paladium for these wonderful



MORO SAILBOATS, "VINTAS."

species^a of forest trees, which produce the bulk of all the gutta-percha used in commerce.

As the demand for gutta increased and the trees of the species *Pal. gutta* became scarcer and more difficult to reach, the native collectors were not slow in finding other species that produced gutta-percha, though of an inferior quality. Chief among these *Pal. treubii* Burck, *Payena leerii* Benth. et Hook. f. fil., and *Mimusops balata* Gartner fil. are the best known. Many other species have been found in Sumatra, Borneo, Celebes, and the Malay Peninsula, but what part they play in the production of the gutta-percha of commerce has not yet been determined.

The accompanying photographs will show some of the resemblances and differences between the species above mentioned. The trees of the genus *Palaquium* are among the largest of the tropical forest, and are generally to be noted by the brilliant green color of their leaves above and the golden to copper-brown shimmer below.

The following general description of the botanical characteristics of *Palaquium* is made by Mr. Merrill:

PALAEQUIMUM BLANCO 1837 (DICHOPSIS THWAITES).

Usually large trees with rusty-tomentose branchlets, leaves obovate or oblong, acute or obtuse, petioled, coriaceous glabrous beneath, or densely rusty-tomentose. Flowers fascicled, axillary on the naked branches below the terminal leaves. Calyx lobes 6, in two series, corolla lobes 6. Stamens 12 to 18, attached near the base of the corolla. Ovary 6 celled. Fruit fleshy, ellipsoid, or ovoid, 1 to 2 seeded. Seeds exalbuminous cotyledons, large, fleshy.

In regard to the species *Mimusops balata* mentioned above, it is to be noted that it is the only representative so far known of gutta-percha producing trees in the Eastern Hemisphere. It was discovered in the Guianas in 1857 and contains a fairly good grade of gutta-percha. Obach designates it in his description as a substitute for gutta-percha in all its chemical and physical characteristics. Though of an inferior grade to that coming from *Palaquium gutta*, it may well be classed among the rest of the *Palaquium* and *Payena* species, furnishing second and third grade gutta-percha.

The gutta-percha trees of the Philippines embrace both *Palaquium* and *Payena* species, and while their complete determination or identification is still unfinished, those which produce the gutta-percha of commerce have been located, and their final identification is only a matter of collecting more complete herbarium material.

^a Of late years the Dutch and English botanists in the Orient have been inclined to divide *Pal. gutta* into three species, viz, *Pal. gutta*, *Pal. oblongifolium*, and *Pal. borneense*, but as no certainty of differentiation yet exists, while the gutta-percha from all is the same, they may for the present be all classed under *Pal. gutta*.

The following table, No. 5, gives the species at present known. Those marked (*) probably furnish the largest part of the gutta-percha exported from the southern islands.

Table No. 5.

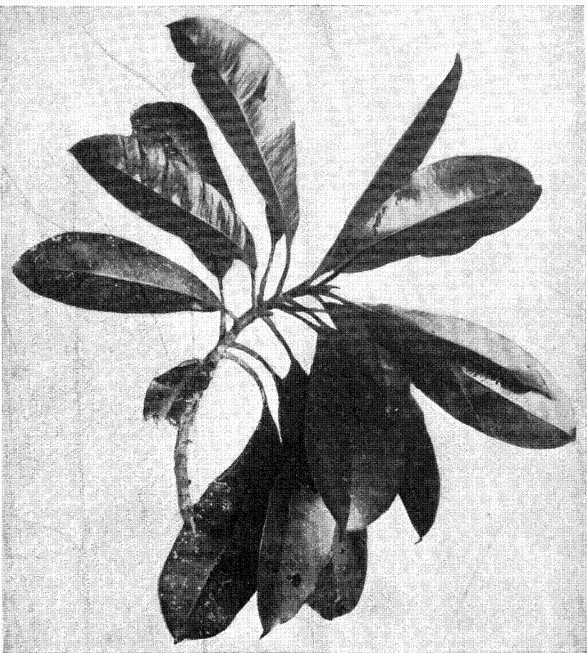
Species.	Local name.	Locality.	Botanical description.
Leaves rusty, tomentose beneath:			
Pal. latifolium Blanco ..	Polacpolac or alacap.	Luzon to Mindanao.	Leaves obovate, obtuse, 10 to 30 cm. long, 5 to 15 cm. wide. Nerves, about 15 pairs.
Pal. oleiferum Blanco...	Alacap or daracan.	Luzon	Leaves obovate-lanceolate, 10 to 25 cm. long, 6 to 10 cm. wide, acute. Nerves, about 15 pairs, closely related to the preceding.
Pal. barnesii Merrill	Nato.....	Masbate	Leaves obovate, obtuse, thin, 12 to 15 cm. long, 7 to 8 cm. wide. Nerves, 11 pairs.
Pal. ahernianum Merrill*	Calapia.....	Mindanao	Leaves ovate or obovate, obtuse or acute, 12 to 14 cm. long, 5 to 6 cm. wide. Nerves, 15 pairs.
Leaves glabrous beneath:			
Pal. celebicum Burck* ..	.....do .....	.....do	Leaves lanceolate, acute, 15 to 20 cm. long, 5 to 6 cm. wide. Nerves, 12 to 14 pairs.
Pal. cuneatum Vidal	Dulitan	Luzon	Leaves ovate, lanceolate or obovate, acute or obtuse, 5 to 7 cm. long, 2 to 3 cm. wide. Nerves, 11 to 12 pairs. Indistinct.
Pal. gigantifolium Merrill .....	.....do	Tayabas	Leaves obovate, 50 cm. long, 20 cm. wide. Nerves, 20 to 24 pairs.
Pal. luzoniense Vidal ...	Bogalafgit	Luzon	Leaves ovate, acute, or obtuse, 10 to 14 cm. long, 4 to 6 cm. wide. Nerves, 12 pairs.
Pal. mindanaense Merrill.*	Calapia.....	Mindanao	Leaves ovate, acute, 9 to 12 cm. long, 4 to 5 cm. wide; petioles 3 cm. long. Nerves, 14 to 16 pairs.
Payenaleerii Berth and Hook.*	.....do	Tawi-tawi....	Leaves ovate or ovate oblong, 5 to 10 cm. long, 2.5 to 4 cm. wide, cuneate at the base, short, acuminate at the apex.

GEOGRAPHIC DISTRIBUTION.

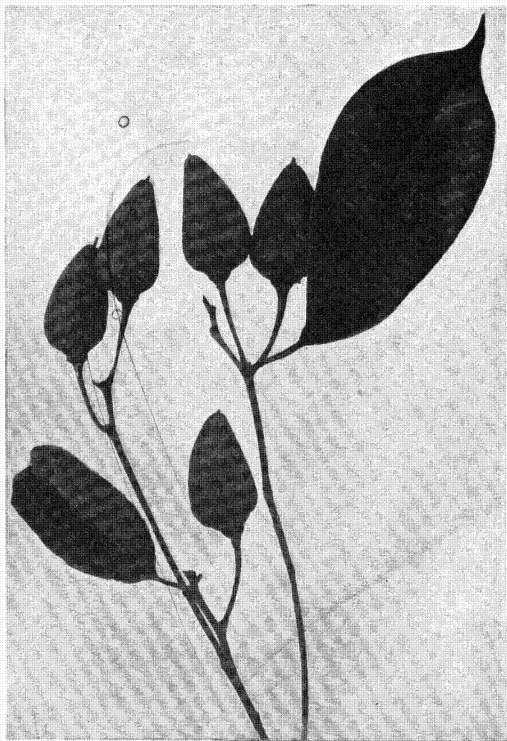
As previously stated, the first gutta-percha trees were reported from the island of Singapore, and, in fact, within a few miles of the city itself. When the substance became a marketable article these trees were the first to fall and all of the island was soon devastated. The explorations, from Singapore as a center, were made in all directions and with remarkable success. All of the forest of the southern half of the Malay Peninsula gave large yields, as well as the islands of the Rhio Archipelago, Borneo, and most of Sumatra. However, from all of the data which have been gathered from native sources, as well as from the information collected by many Dutch, English, and French explorers, it appears that the area of distribution of the *Palaquium gutta* trees is sharply defined. Beyond the sixth degree north on the Malay Peninsula the trees became scarce or ceased altogether; on the northern end of Sumatra they are likewise lacking. Java, bordering close on Sumatra, contained none, and Celebes, to the east of Borneo, was found to be equally destitute. Reference to the map will show the area of distribution of the *Palaquium gutta*, which is practically included in a parallelogram inclosing the above-mentioned peninsula and islands. This area included some 450,000 square miles of land, of which only a very small per cent is or ever was covered by gutta-percha trees.

Obach, in his celebrated book on gutta-percha, practically limits the area of gutta-percha production for the entire world to this small territory. While this statement is probably true, so far as the gutta-percha from *Palaquium gutta* is concerned, we have already seen that the area of distribution of the other or inferior species is extended eastward so as to take in the Philippines, and the same is also true of Celebes, Java, and the northern half of the Malay Peninsula.

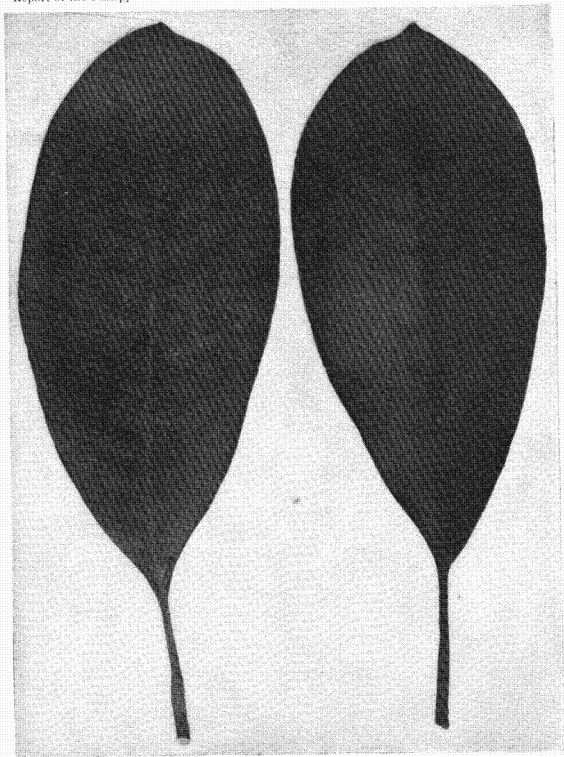
The number of gutta-percha producing species in the Philippines has already been listed, and some of the localities given where they have been found. Attention is again called to the distributing of these localities, extending so far north as well as south, and it can be confidently expected that when the forest surveys are completed nearly all of the islands will be found to contain some species in more or less abundance.



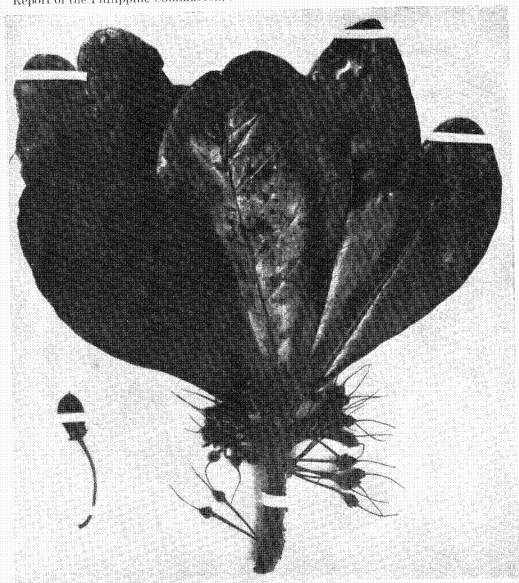
LEAVES OF PALAQUIUM GUTTA BURCK, GROWN IN BOTANICAL GARDEN, SINGAPORE.
FURNISHES FIRST GRADE GUTTA-PERCHA.



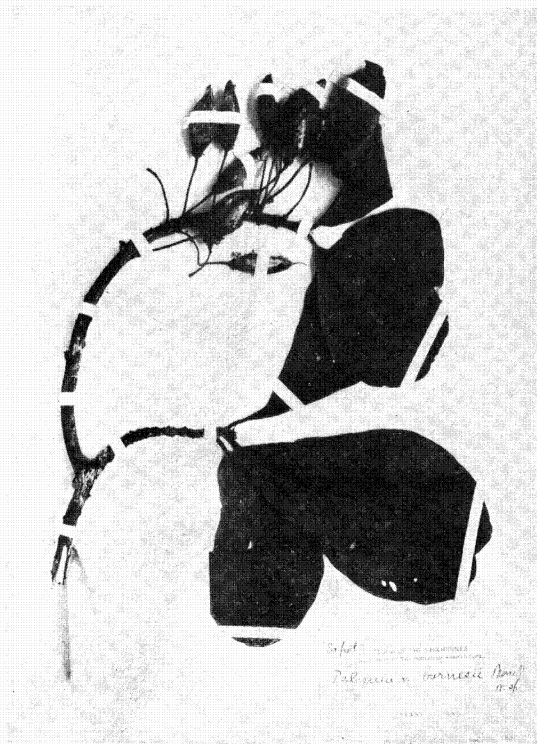
LEAVES AND FRUIT OF *PAYENA LEERI* BENTH. ET HOOK, FROM BUITENZORG, JAVA. FURNISHES SECOND GRADE GUTTA-PERCHA.



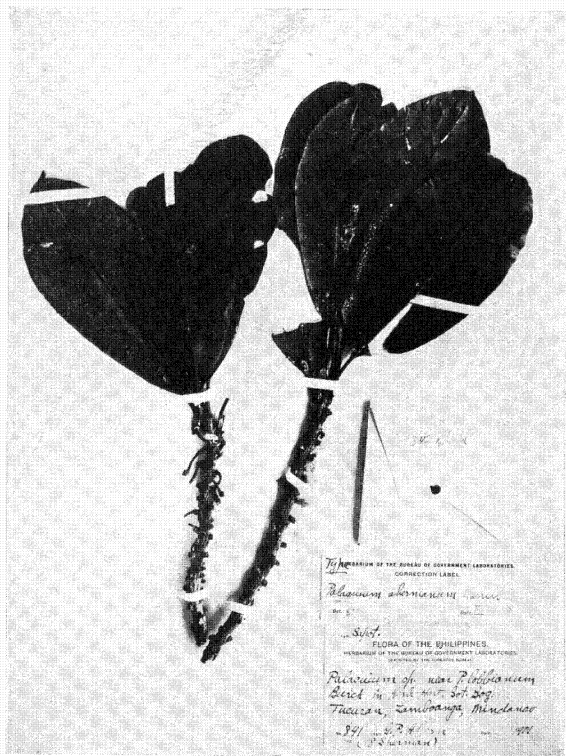
LEAVES OF PALAQUIUM TREUBII BURCK, GROWN AT BUITENZORG, JAVA. FURNISHES
SECOND-GRADE RUBBER.



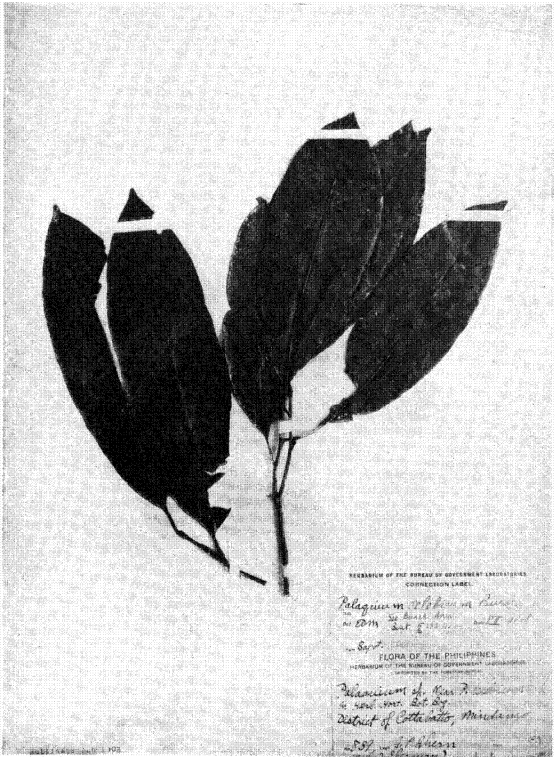
PALAEQUIM LATIFOLIUM BLANCO, PROVINCE OF TAYABAS, LUZON.



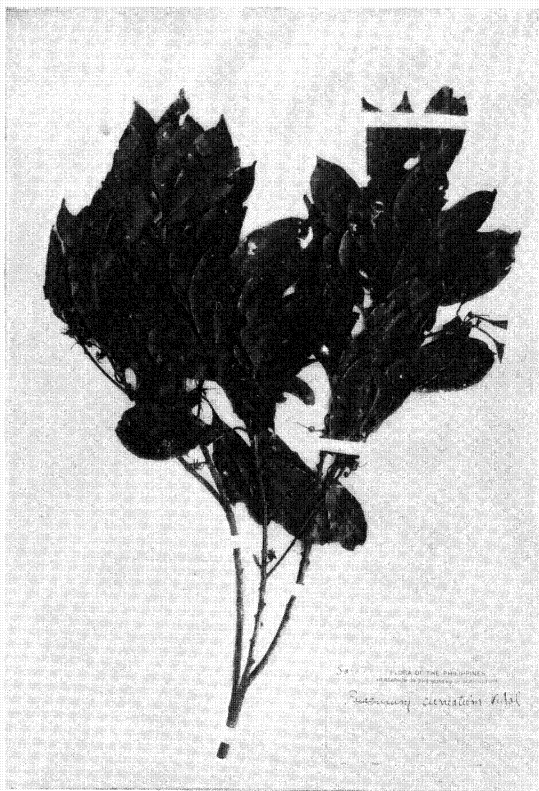
PALAUQUUM BARNESII MERRILL, ISLAND OF MASBATE.



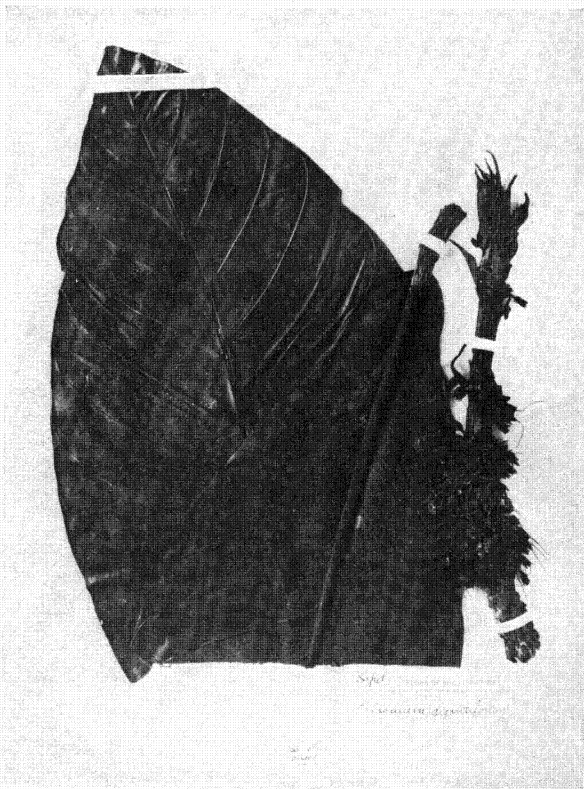
PALAEQUIM AHERNIANUM MERRILL, TUCURAN, DISTRICT OF ZAMBOANGA, MINDANAO.



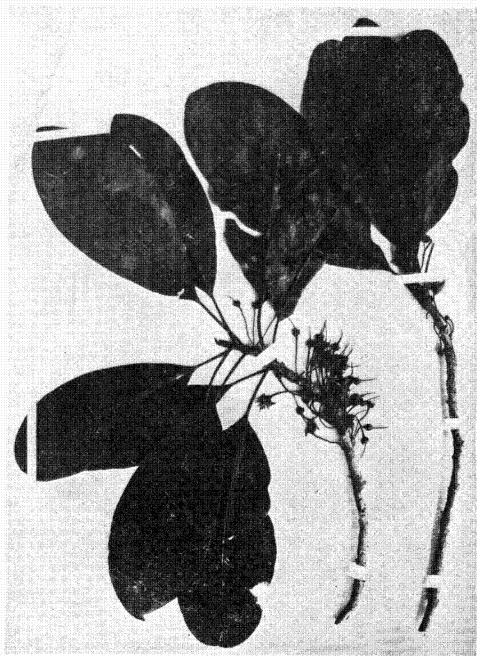
PALAEQUIM CELEBICUM BURCK, DISTRICT OF COTTABATO, MINDANAO.



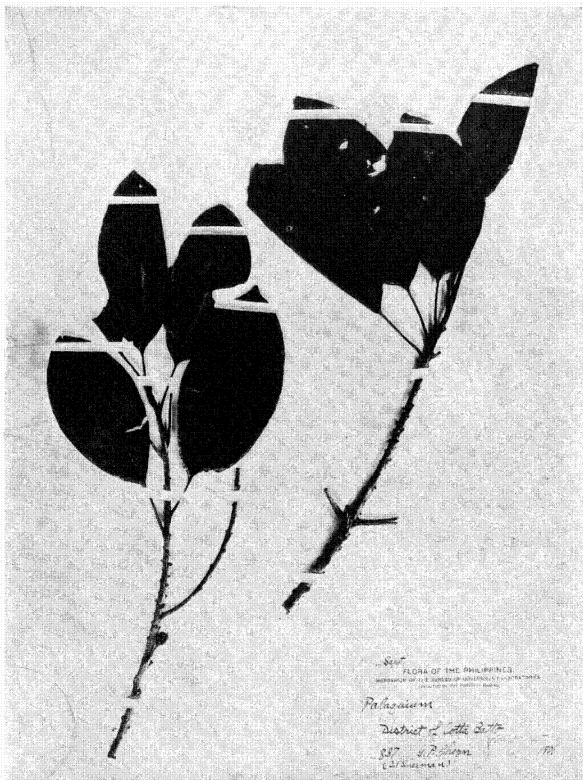
PALAEQUIM CUNEATUM VIDAL, PROVINCE OF TAYABAS, LUZON.



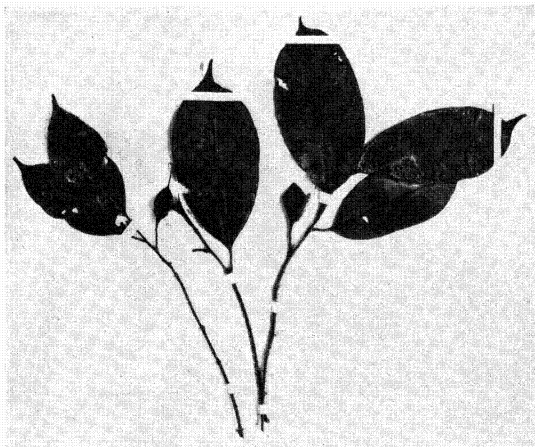
PALAEQUIM GIGANTIFOLIUM MERRILL, PROVINCE OF TAYABAS.



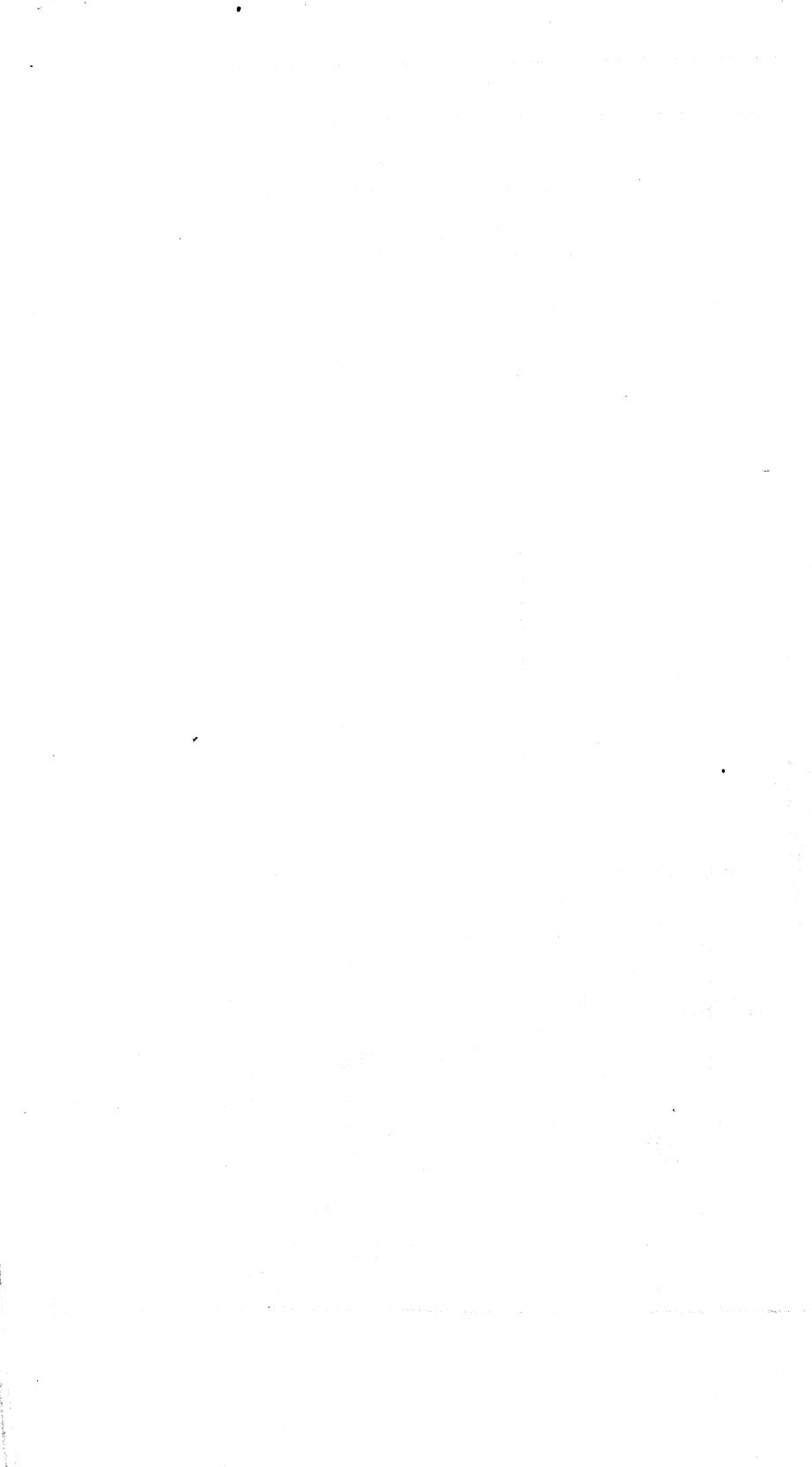
PALAEQUIM LUZONIENSE (F. VILL) VIDAL, PROVINCE OF TAYABAS, LUZON.

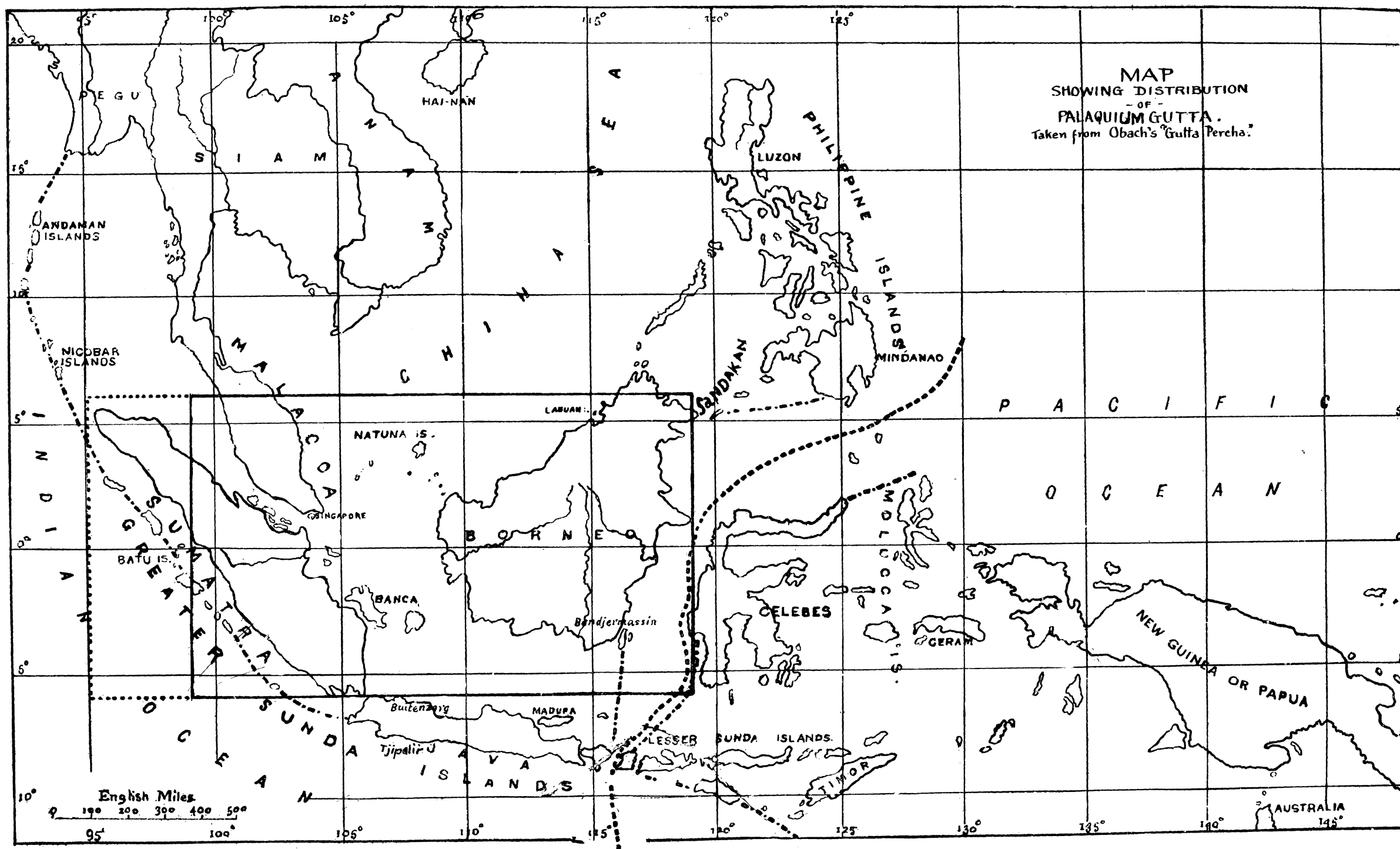


PALAEQUIM MINDANAENSE MERRILL, DISTRICT OF COTTABATO, MINDANAO.



PAYENA LEERII (T. ET B.) BENTH. ET HOOK, TAWI TAWI.





Map No. 1.

Owing to the limited extent of the areas where gutta-percha trees have so far been found on most of the islands, the regions which produce gutta-percha for the market at the present time are limited to the islands of Mindanao and Tawi-tawi. The accompanying map is arranged to show the places where gutta-percha species have been found as well as to give some idea of the size of the districts producing the gutta-percha now being exported. The exact or even approximate extent of these areas is difficult to calculate. Much has not yet been explored, and the information derived from the natives is vague and contradictory. The areas on the map are given conservatively and are known to produce gutta-percha at the present time. Other territories will probably become known as our intercourse with the wild tribes inhabiting these regions grows more friendly and open.

List of towns and forest regions from which gutta-percha is exported to Singapore.

Central point for collection and exportation of gutta-percha.	Point of collection of gutta-percha from the various forest regions.	Name of forest regions from which gutta-percha is collected.
Cotabato	Tukuran and Dinas	Dinas-Subano. • Camalarang. Labangas. Tukuran. Laguna de Lanao. Baras. Liangan. Segayan. Tagabuli. Manobo. Bilan. Binang.
	Malabang	Dama Balao. Matingaunan. Talayán.
	Clan, Surangani, and Binang	Western and northern Subano.
	Reina Regente and Salaya	Tawi-tawi.
Zamboanga	Baluan, Curuan, Talucsang, Puerta Sta. Maria, Dapitan, Misamis.	Do.
Jolo (Sulu)	Transshipped from Davao, Cotabato, Zamboanga, or Siassi.	
Bongao	Siassi, Balimbing, Buan, Dajapatan	

METHODS OF COLLECTING AND MARKETING.

The question of what is the best method for collecting gutta-percha has troubled owners and dealers from the beginning and a satisfactory answer is still lacking. The trees are in the tropical forest regions of the Malay Archipelago, Borneo, and the Philippines, which are inhabited by the wildest pagan tribes only. These natives are the natural gutta-percha collectors, and as a matter of fact have done all the collecting since the beginning. They evolved a method which answered their requirements very satisfactorily. As might be inferred, they wished the maximum yield of gutta-percha from each tree with the minimum expenditure of work or time. That the method was extremely wasteful did not concern them, nor were they bothered over the prospect of a bankrupt future.

The method which is still in vogue from the westernmost part of Sumatra to the easternmost point of Mindanao is, with various minor modifications, practically as follows: The tree is first cut down and the larger branches at once lopped off, the collectors say, to prevent the gutta-percha milk from flowing back into the small branches and leaves. As has been previously stated, the milk or latex is contained in the inner layers of the bark and leaves in small capillary tubes or ducts (see photograph, fig. 27). To open these so as to permit the maximum amount of the milk to escape, the natives cut rings in the bark about 2 feet apart along the entire length of the trunk. The milk as it flows out is collected in gourds, coconut shells, large leaves, or, in some districts, in the chopped-up bark itself, which is left adhering to the tree for the purpose of acting as a sort of sponge. After one or two hours, when the milk has ceased to flow, the contents of the receptacles are united and boiled over a fire for the purpose of finishing the partial coagulation. The warm, soft mass is then worked with cold water until a considerable amount is mechanically inclosed. To further increase the weight, chopped bark, stones, etc., are added, and the whole mass kneaded into the required shape with most of the dirt on the inside.

The gutta-percha gathered in this way well repays the amount of work expended. The two vital defects of the method are:

(1) The method is very wasteful, the yield from each tree being a small proportion of the total amount. What this per cent is has been investigated by scientists, with

the result that the figures differ widely. Remembering that the gutta-percha milk is contained in capillary ducts and tubes, it will be seen that a considerable amount can not flow out on account of capillary attraction, no matter how much cutting is done. It very seldom happens also that a tree falls in such a way that all its trunk is so exposed as to admit ringing on all sides. As a general thing from one-third to one-half of it is inaccessible to the process of ringing, and all the milk within it is consequently lost. Even the larger limbs are not deemed worth ringing and consequently all the milk in them and in the leaves also goes to waste. To this must be added the considerable quantity spilled on the ground through carelessness and lack of enough receptacles for every cut or bruise from which the milk flows.

The method employed to find what percentage of gutta-percha has been removed from a tree by the native collectors was to determine the per cent of gutta-percha remaining in a given area of the bark, multiply this by the total bark area of the tree and adding 15 per cent of this amount for that contained in the bark of the branches and in the leaves.

The amount which the native collectors secure from the average full-grown tree apparently varies according to the species, season, personnel of collectors, etc. Most authorities place the amount per tree at one-fourth of a pound. The director of the botanical garden in Penang secured $1\frac{1}{2}$ pounds of clear gutta-percha from a large tree (*Pal. gutta*) estimated to be 60 years old. Ury obtained somewhat over 2 pounds from a *Palaquium gutta* tree at least 100 years old, and $2\frac{1}{2}$ pounds from one of an inferior species.

Burck made some extended experiments in Sumatra and secured an average of less than 1 pound from full-grown trees, while Serullas in Sumatra obtained almost 1 pound from a giant tree. Trees of inferior grade have been found to give as high as 8 pounds. Probably the best average obtainable is 3 pounds. In the Tiruray district of Mindanao I secured 1 pound of clean gutta-percha from a tree 135 feet high and 5 feet 4 inches in circumference at the base. The work was carefully done by the natives. Taking a measured amount of the bark of this tree after no more gutta-percha could be collected by the native method, and extracting all of the gutta-percha that it still contained, it was estimated that after collection there still remained $6\frac{1}{2}$ pounds of gutta-percha. Taking into consideration the fact that had the tree not fallen in such a way as to leave almost all of the trunk propped high enough above the ground to allow the milk to be extracted from the bark on the under side, the amount extracted would undoubtedly have been much less, or, in other words, ten times more gutta-percha would have been left to rot with the tree than was taken from it by the natives. Other investigators have secured figures as large as these, and some found that forty times more gutta-percha was left behind than was secured by the careless collectors.

(2) It leaves the future unprovided for. It has been seen that the invariable practice of the native collectors is to fell the tree in order to extract the gutta-percha. In some cases it has been reported that the stumps stool afterwards and in course of time produce new trees, but it can be safely asserted that this is the exception and not the rule. Of those I have found cut down in the Philippines none have ever stooled, though in one case I saw some of the roots of the stump alive long after the felled tree was well advanced towards decay.

It is fortunate that only the full-grown trees contain enough gutta-percha to repay the work of felling, ringing, etc., otherwise the complete extermination of the gutta-percha forest would only be a matter of a year or so. On the other hand, the felling of all the trees old enough to bear seed works to the same end with a somewhat longer time limit.

THE MARKETING OF GUTTA-PERCHA.

Having been collected and put in marketable shape, it is carried in baskets on the back of the collectors to the nearest waterway and thence taken by boat to the most accessible town, where, applying the description to the Philippines, it is exchanged for barter to some Moro, Chinese, or Filipino merchant (commerciant) living there for the purpose of dealing in all kinds of native products. From here it is shipped to one of the ports doing an export trade with Borneo and Singapore. The entire gutta-percha trade is practically in the hands of the Chinese in the latter city, and they guard the secrets of boiling, working over, mixing, adulterating, and cooling the gutta-percha for European markets most zealously. All who have tried to investigate their methods agree that there is no connection between the various grades and the different tree species, and that pure gutta-percha from the species *Palaquium gutta* is no longer found on the market unmixed with inferior grades.

Strangely enough, I was unable to find in Singapore any statistics regarding the importation of Philippine gutta-percha. The Chinese dealers denied receiving any,

and beyond a few piculs noted in the annual import statistics, no mention of it was found anywhere. I afterwards ascertained that the gutta-percha first goes to Sandakan and Labuan, in British North Borneo, and is there transhipped to Singapore, entering as North Borneo gutta-percha.

Unfortunately, the amount collected for exportation can not be given with any degree of accuracy, as the export statistics include gutta-percha with all other gums. It is known, however, that the amount reaches into tens of thousands of pounds.

LAWS REGULATING COLLECTING AND SHIPPING.

Considering the almost lawless way in which gutta-percha is collected and marketed, it is pertinent to review briefly the few steps taken towards legislating on the subject. The English long ago realized that the gutta-percha forests of the Malay Peninsula were doomed to destruction unless radical measures were taken to change the method of collecting. The first law passed was to prohibit the felling of trees in order to collect the gutta-percha. As the law never penetrated to the wild tribes of the interior, where the collecting was done, it was not effective. As a surer method of stopping the destruction, a second law was passed which prohibited the exportation of gutta-percha from coast towns in the Federated Malay States in which the English could, of course, exercise personal supervision. The result was that the exportation from those places ceased promptly, but the felling of trees did not stop, the export simply traveling northward by overland routes until it was outside of English jurisdiction, and from there it was shipped to Singapore. I can not find that anything effectual has been accomplished by the English nor by the Dutch authorities in Sumatra and Borneo toward remedying the difficulty. It seems to be generally realized at last that wild natives can not be prohibited from doing things where there is no law nor show of authority. Certainly they will not cease felling gutta-percha trees until some one can show them an easier method for collecting the same amount or more of the material, so long as gutta-percha has a market value. The English had the true idea when they took away its market value through prohibiting exportation. The only trouble was that the Malay States are on a peninsula and not an island. This law, if applied to the Philippines, might succeed better by reason of their geographical situation, but so far nothing of this kind has been tried here. As soon as the forestry bureau was established, in 1899, the felling of gutta-percha trees was prohibited. Rules and regulations were provided for tapping the bark of the tree with a bolo in such a manner as to allow the milk to be secured without killing the tree. As the amount of gutta-percha obtained by this process was much less than that secured from felling the tree, while the labor was fully as great and was dangerous besides (some trees being 70 feet to the first limb) the wild natives never practiced this method, nor did they ever hear of it, and all the gutta-percha so far exported has been at the expense of so many trees killed.

Islands such as Mindanao and Tawi-tawi can not stand this for any length of time, and already the gutta-percha trees have entirely disappeared from the vicinity of the coast regions and of the large rivers. According to the forest surveys made so far in the islands the average number of trees of 1 foot in diameter is between 40 and 50 per acre, and, considering the large number of species found in the forests, the number of trees of any one species is generally placed at four or five. With this liberal allowance the forest acreage of the southern islands will probably supply gutta-percha, at the present rate of cutting, for three or four years longer, but not for more than that.

It must not be supposed that scientific investigation has not been directed toward solving this vexed question of securing gutta-percha in paying quantities without killing the trees, but before describing the results of this work, the chemical and physical characteristics of gutta-percha, as well as the prices to be realized for the same, must be considered, in order to demonstrate the difficulties to be overcome.

GRADES AND PRICES.

The prices governing the sales of all grades and kinds of gutta-percha in Singapore, the chief market of the world, seem to be most arbitrary and uncertain. As a general thing they have increased continuously and steadily since the beginning of the industry.

Formerly, the different kinds of gutta-percha were named from the well-known districts or shipping ports from which they came. An attempt was also made to designate the species of tree furnishing the product, and a further distinction was given as to quality. For instance, "Koatei guta merah No. 1" was first grade of gutta-percha from the species *Palaquium guttu* coming from Koatei, while "Pahang

white soondi No. 1" was first grade gutta-percha from the specie *Payena leerii* from the Pahang district.

These names and gradings are still kept up as a matter of convenience for cable codes, etc., but their significance is almost entirely lost, certainly as far as any indication of the tree species is concerned, and often as regards the district of production as well. The Philippine gutta-percha, for example, has no grading nor price in Singapore, and probably comes in under Sarawak white, red, etc.

As has been stated previously, the secrets governing the selection, boiling, adulteration, coloring, etc., of the various grades are closed and known to the Chinese exclusively. This is also true in the Philippines, though very little except boiling and cleaning is attempted before shipping to Sandakan.

Most of the Philippine gutta-percha passes through three hands, and the rise in price is quick and decided. My experiences in the gutta-percha districts of Mindanao and Tawi-tawi were to the effect that the wild native collector had to take about what he could get, which was on an average of \$10, Mexican, for a picul of 162½ pounds. Money was seldom paid, the usual thing being barter in rice, cloth, copper wire, cheap jewelry, beads, etc. It is needless to remark that the middleman realized a good profit on his merchandise. He in turn carried the gutta-percha to the export towns and sold it to the Chinese at the rate of \$40 to \$80, Mexican, per picul of 137½ pounds. As this latter amount was the legal weight for a picul, his profits were increased by the additional pounds which he deliberately stole from the ignorant native. The Chinese exporter pays \$5 to \$7, Mexican, per picul forestry dues (he being the only one of the three with a fixed residence and amenable to forestry regulations) and exports the gutta-percha to Sandakan or Singapore, where it probably brings \$100 to \$150, Mexican, per picul of 133½ pounds. There is no definite information on this subject, however, as Philippine gutta-percha, as has been stated, is neither rated nor graded in Singapore. A year and a half ago when the best grade of gutta-percha in the Philippines was said by the Chinese of Cotabato to be worth \$80 per picul, the following analyses of Singapore gutta-perchas were made by V. Romburgh and Tromp de Haas:

Grade.	Dirt.	Water.	Resins.	Gutta.	Price per picul (Mexican).
Bila (red) Soondi	33.6	7.0	31.4	28.0	\$150
Sarowac Soondi No. 2	37.1	6.8	26.5	29.6	135
Pinang gutta Palelo No. 1	2.1	5.8	53.8	38.3	180
Sarawak red Soondi No. 1	19.0	3.9	35.5	41.6	350
Bagan white Soondi No. 1 .....	.7	8.6	36.5	54.2	350
Koatei gutta merah No. 2	21.7	5.1	28.5	44.7	360
Indragiri white Soondi	2.0	4.1	46.2	47.7	370
Sambas white Soondi	1.0	4.4	53.6	41.0	380
Koatei gutta merah No. 1	14.8	3.8	34.8	46.6	500
Pahang white Soondi No. 1	4.2	.5	12.8	82.5	500

According to these analyses the best grades of Philippine gutta-percha may well rank with any of the first four on the list, especially as my chemical and physical tests show the high grade of the gutta in them.

Another example of the difficulty in dealing with the Chinese gutta-percha merchants in Singapore is the experience of an American merchant of Manila who, about this time, took a considerable quantity of the best grade of gutta-percha from Mindanao over to Singapore by way of speculation. He was only offered \$8 per picul by the leading merchants there, and it was not until they found out he was not anxious to sell at all, but would ship it to America, that they finally closed with him at \$70 per picul. How much the gutta-percha was really worth he never found out.

The evidence then all goes to show that the price of Philippine gutta-percha jumps from about \$8 a picul in the mountains, where it is gathered by the wild tribes, to \$150 in Singapore. Thus the native collectors get almost nothing, the government about as much, and the Chinese the rest. The Chinese might possibly get even higher prices by exporting direct to London or America, though apparently this has not yet been tried.

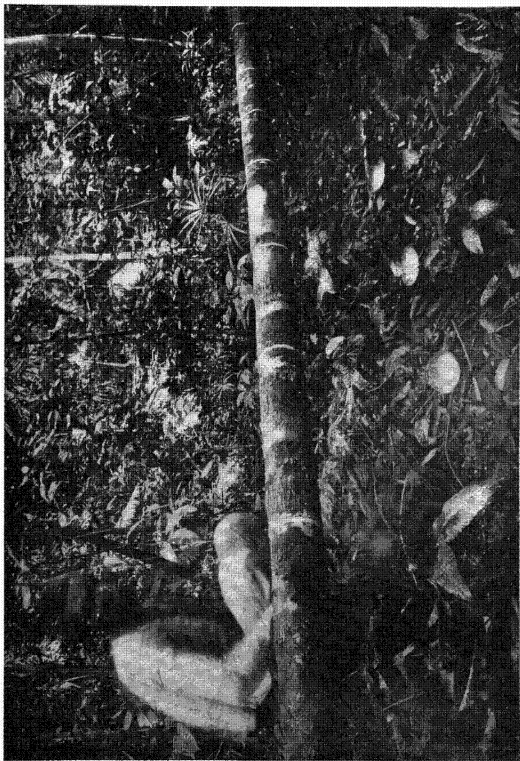
It is stated on good authority that the Chinese in all their manipulations for preparing the gutta-percha for the European market go solely by smell, color, toughness, and the softening and hardening test in hot then cold water. At any rate they are certainly very skillful in the work, although careful inspection of the above table, as Van Romburgh points out, would tend to show that their prices were not at all warranted by the analyses. So long as the collecting of the gutta-percha is all in the



GUTTA-PERCHA LEAF (PALAQUIUM GUTTA) ENLARGED, SHOWING FIBERS OF GUTTA-PERCHA PERMEATING THE LEAF INTERIOR.



READY TO FELL A LARGE GUTTA-PERCHA TREE FOR EXPERIMENTAL PURPOSES, DISTRICT OF
ZAMBOANGA, MINDANAO.



TAPPING A GUTTA-PERCHA TREE SO THAT ALL THE MILK IS COLLECTED IN SHELLS BENEATH. DONE BY MOROS IN TAWI TAWI.



LARGE GUTTA-PERCHA TREE TAPPED SO THAT THE FLOWING MILK IS ALL ABSORBED, TIRURAY DISTRICT, MINDANAO.



A GUTTA-PERCHA TREE FELLED BY THE SUBANOS, NEAR CURUAN, DISTRICT OF ZAMBOANGA, MINDANAO.



STEM OF GUTTA-PERCHA TREE, SHOWING SCAFFOLDING, ZAMBOANGA.



LARGE GUTTA-PERCHA TREE FELLED AND RINGED, DISTRICT OF ZAMBOANGA, MINDANAO.

hands of wild natives and the manipulating and marketing controlled by the Chinese, we can not hope to have the gutta-percha trade on a fair business basis. However, as the supply steadily decreases while the demand and prices increase, the attention of Governments and manufacturers will more than ever before be directed to the subject, and perhaps the hoped for relief will come through scientific propagation of gutta-percha trees and scientific collecting of the gutta-percha.

CHEMICAL PROPERTIES.

A chemical examination of the milk or latex above referred to as coming from the gutta-percha trees, upon wounding the bark, shows it to be composed of an emulsion of water and oil in a finely divided state. According to the species of tree, the water varies from a small (best species) to a very large percentage (poor species). A drop of the milk caught on the finger undergoes no apparent change for a few minutes, but by the end of this time a thin rubbery scum can be observed to have formed on the surface. If this be removed a second film will form, and so on until the entire drop has become a small piece of a tough leathery substance. When a fresh drop is worked between the fingers the hardening process or coagulation takes place very quickly, and by boiling or adding certain chemicals, such as mineral or vegetable acids, alum, salt, etc., it takes place almost instantaneously. What the nature of this hardening process is appears to be unknown. The subject will be investigated in this laboratory.

After coagulation sets in (see below) the oily portion becomes hard and tough, while most of the water separates or is inclosed mechanically. Subjecting this hard and tough mass, taken for example from the *Palauquium gutta* species to further examination, it proved to be insoluble in water and very stable against the action of either dilute acids or alkalies. In chloroform or carbon bisulphide it is easily soluble, while ether, petroleum ether, and alcohol dissolve it only in part. By subjecting it to the action of cold alcohol a yellow amorphous resinous powder can be extracted. Hot alcohol further extracts a white crystalline resin, leaving a tough horn-like residue which is easily soluble in chloroform and carbon bisulphide, and can be precipitated from these solutions by alcohol as a white flocculent mass, which, by warming or through pressure, quickly turns to its original appearance. Taking the three constituents of gutta-percha in the order described above, the names fluavil, alban, and gutta were given them by Payen in 1852. Besides the constituents, all gutta-percha was found to contain more or less dirt, coloring matter, and water inclosed mechanically.

The method adopted for making the above analyses is a modification of those used by Obach and Van Romburgh. The former determined first the per cent of water by drying a weighed sample to constant weight on a water bath or desiccator, determining the water by difference. The resins were then extracted with ether and weighed after the solvent had been completely evaporated. The gutta and dirt were thus left and were separated by chloroform, which dissolved the gutta, leaving the dirt to be filtered, dried, and weighed. The chloroform was then evaporated and the gutta weighed.

Van Romburgh in his latest analytical work uses the following scheme: The weighed and finely divided substance is dried to constant weight in an atmosphere of dry carbon-dioxide gas, which fulfills the double purpose of drying and at the same time preventing oxidation. The sample is then dissolved in hot chloroform, thus allowing the undissolved dirt to be filtered off, washed, dried, and weighed. The chloroform solution containing the gutta and resins is diluted with chloroform to 100 c. c. and an aliquot portion taken, evaporated, and dried to constant weight as above. By extracting the residue with hot alcohol or acetone the resins are removed, when the remaining gutta is dried and weighed. The resins are then estimated by difference. Van Romburgh points out that the largest source of error in using this method is due to the evaporation of the chloroform. To avoid this loss and save time the following modifications were adopted:

Dirt.—A fair sample of the gutta-percha to be analyzed was finely divided and quartered down to a small amount. Of this 0.3 to 0.5 gram were taken in a weighed thimble filter and extracted hot in a Soxhlet apparatus, chloroform being used as the solvent. When all was dissolved but the dirt this was dried in the filter and weighed.

Resins and gutta.—The chloroform solution is then evaporated to dryness in the same flask (previously tared) dried to constant weight on the water bath in a stream of dry carbon-dioxide gas. After weighing, the contents are extracted with hot alcohol or acetone, when the flask is again dried as before and weighed. The loss in weight equals the weight of resins, and gain of the flask in weight that of gutta.

Water (estimated by difference).—Analyses of samples taken from several trees of one species show that the percentages of the constituents vary considerably, being influenced, probably, by the age of the tree, the conditions of its growth (soil, moisture, shade, etc.), as well as by the season at which the sample was taken. For illustration of this two analyses of gutta-percha, known to have been taken from different trees of *Palaquium gutta*, are given to show the large variation in the percentage of gutta. It must therefore be understood that the figures obtained from the analyses of the gutta-percha taken from any one tree will not necessarily represent the exact values for that species. An average from a number of trees is necessary to secure true values. In the same way samples from any commercial grade of gutta-percha may vary quite a little in their percentage composition, the differences, however, generally falling within a well-defined limit.

The "dirt" found in all commercial gutta-percha, as has been stated, may be there unintentionally or have been added with intent to defraud. In either case it consists generally of finely chopped bark, leaves, small sticks, etc. From 2 to 6 per cent of dirt is not only admissible but generally unavoidable, while more than that is looked upon with suspicion. So intimately is some of the dirt mixed with the gutta-percha that even the best machines fail to eliminate the last 1 or 2 per cent.

A certain amount of coloring matter, which exudes from the bark when cut, is also mixed with the gutta-percha milk and colors the resulting gutta-percha. Certain species give a distinctive color to the material taken from them, so it has become a practice of the Chinese in Singapore to boil inferior grades with the bark of the best species, in order to give them the correct color.

Under "resins" are considered the resinous-like substances which with gutta go to form the substance gutta-percha. These resins vary greatly in appearance. In gutta-percha from *Palaquium gutta*, for example, as has already been stated, one is a white crystalline mass, while the other a yellow amorphous powder. In other species they may be oily or brittle, colored or white. Judging from the formulas, $C_{10}H_{16}O$ and $(C_{10}H_{16}O)_x$, which have been given to alban and fluavil, respectively, it might be inferred that these resins are oxidation products of gutta ($C_{10}H_{16}$). Sufficient work has not yet been done on these bodies, however, to make this anything more than conjecture.

Again taking the gutta-percha from *Palaquium gutta*, for illustration, it is found that the 10 to 20 per cent of resins which it contains is not a detriment but rather a decided advantage. Besides adding much to the bulk they are insoluble in water, poor conductors of electricity, and quite stable against the action of air and moisture. In fact, gutta-percha at present prepared for the insulation of submarine cables is composed of one part of resins to every two parts of gutta. When the amount of resin passes this percentage, however, the toughness of the gutta-percha is lessened and other objectionable qualities become apparent. The necessity, then, of knowing the percentage of resin in a given quality of gutta-percha before using it for manufacturing purposes is plainly apparent.

As might be inferred from the preceding, the "gutta" is the principal constituent in gutta-percha. The methods of separating it from the other constituents have been given and its indifference toward dilute acids and alkalis noted. Concentrated nitric acid causes violent oxidation, while sulphuric carbonizes it in a short time. Alkalis, even when concentrated, have practically no action on it. The best solvents for gutta are chloroform, carbon bisulphide, and carbon tetrachloride. From all of these solutions it may be reprecipitated by the addition of alcohol.

If gutta be subjected to dry distillation, isopren, C_5H_8 , and kautchin, $C_{10}H_{16}$, distil over as the chief decomposition products, and are identical with the isopren and kautchin recovered from the dry distillation of rubber. Tilden succeeded in changing isopren back again into a rubber-like substance through the action of concentrated hydrochloric acid. As isopren, according to Ipatiew and Wittorf, is methyl divinyl, $CH_2=C(CH_3)-CH=CH_2$, both gutta and rubber will perhaps be found to be polymerization products of isopren.

The discussion has so far been of the gutta found in the species *Palaquium gutta*. Dr. Eugene Obach, as chemist for a large cable insulating company, made analyses of specimens of gutta-percha from different species of trees as well as from many grades of commercial gutta-percha. In his table of analyses he puts under the name of "gutta" the substance found in each sample, which was insoluble in boiling alcohol but soluble in chloroform. The "guttas" thus found were variously colored from white to dark brown, and possessed different tensile strength from "elastic" and "very strong" to "brittle." Obach thus used certain slight chemical similarities as his criterion of a gutta and neglected, apparently, the wide physical differences which these bodies, as will be shown later, display. Provided there are many kinds of guttas, it is then easily understood that a chemical analysis alone of a gutta-percha will give

almost no insight into its value unless accompanied by physical tests of the gutta contained in it.

Before going further with the discussion as to whether chemical or physical tests should decide what is or is not "gutta," attention is called to the various physical properties of these bodies before mentioned. To provide material for these physical tests, they were isolated in considerable quantities from various representative Singapore and Philippine gutta-perchas by means of solvents, and after evaporation were dried in a stream of dry carbon-dioxide gas to prevent any possible oxidation. When heated to the temperature of boiling water they could be easily cut or molded into the necessary shape for performing the following experiments:

Gutta.	Color.	Action toward—			
		Light.		Heat: Softening temperature.	Stress: Tensile strength per square inch.
		Refractive index, 70° C.	Rotation in 0.5 per cent solution.		
No. 1.....	Light brown	1.5093	—6.75	62	<i>Pounds.</i> 5,262.4
No. 3.....	Cream white	1.5088	—6.5	60	6,668.15
No. 4.....	Yellowish white	1.5089	—7.5	61	5,134.7
No. 10.....	Cream white	1.5076	4.75	56	Brittle.
No. 5.....	Very light chocolate	1.5093	—6.5	61	6,451.45

EXPLANATION OF TABLE. *a*

The "color" of the guttas undoubtedly comes from the bark of the tree when cut to secure the gutta-percha, for by repeated solution and precipitation the color may be almost entirely eliminated, leaving the gutta only slightly tinted from a cream color to light pink, and pure white when finely divided. It is my opinion that all variations of color are only incidental and not connected with the chemical structure of the gutta itself. The amount of color in the above samples was minimum and not sufficient to have any material effect on the physical properties. The other experiments with light, namely, those given under refractive index and rotation, are employed with great success in the commercial analysis of sugars, oils, fats, butters, etc. This is due to the fact that each chemical individual, providing it is capable of transmitting light, has an index of refraction peculiar to itself, which, for purposes of comparison, must be taken under constant conditions and, provided it is able to rotate the plane of polarized light, a degree of rotation which is also constant. While two chemical individuals may show identity in some one physical property, they can not continue this identity in two or more, so that more than one method was necessary to determine the relationship of the guttas examined by me. Substitution, adulteration, or variation in chemical structure can in this way be easily discovered and determined. Owing to certain mechanical and chemical difficulties encountered in making these determinations on the guttas, the limits of error of experimentation are outside of the differences found between Nos. 1, 3, 4, and 5, but do not include the marked difference displayed by No. 10. In determining the refractive index, an Abbe-Zeiss refractometer was employed, a small amount of a concentrated solution of pure gutta in chloroform placed on each of the prisms and allowed to stand until the odor of chloroform had entirely disappeared. The prisms were then closed, and kept at a temperature of 70° C. until the readings became constant, showing that all chloroform had evaporated. The above figures are the results of many determinations made with carefully prepared samples.

The rotation was determined in chloroform, 0.5 per cent solution being used, because when more concentrated the absorption of light was too great to admit of accurate readings.

The physical tests given in the above table are so diversified as to bring out clearly the extent of resemblance between the various samples of gutta submitted to them. The results show little variation between Nos. 1, 3, 4, and 5; indeed, these samples may be regarded as practically identical in composition. The physical constants

a The results given in this table and some of the explanations appeared in the previous annual report, but as subsequent experience and the completion of botanical data has led me to take up the subject from a different standpoint, they are again appended for the sake of completeness.

appear to be those of a single chemical individual; the refractive index varies only in the third decimal place; the rotation is the same within the limits of only one degree, and the softening points vary only from 60° to 62° . The small amount of resins in the specimens, which it was impossible to remove, would be sufficient to account for even greater variations. No. 1, however, is the best sample used for a standard, and taken from *Dichopsis gutta*; Nos. 3, 4, and 5 are from the Philippine Islands. It would appear from this that gutta is a chemical individual, identical in all cases, and any substance, such as No. 10, for example, which varies from the properties recorded above should not be designated as such. This opinion is, however, advanced, subject to further confirmation by extended chemical investigation looking toward the determination of the chemical constitution of gutta. In the case of sample No. 10, the substance designated as gutta and the real gutta of No. 3 are very similar in appearance and chemical behavior. In tensile strength, however, they are widely divergent, and this difference is accentuated and not lessened by the other physical tests, for while these latter differences are not so marked, yet they clearly show that all the physical constants of No. 10 differ more or less from all the others, and hence this substance must certainly be different in chemical constitution.

The action of heat in softening gutta-percha and making it plastic has previously been used as a test of value. It has been found that the best grades require more heat to soften them than the lower grades. According to the results obtained by me, the inferior grade of gutta (No. 10) also possesses the property of softening at a lower temperature than the superior gutta. The softening point was determined by molding a piece of gutta into the bottom of a glass tube sealed below, placing a sharp-pointed glass rod in contact with the surface, and gradually heating in a bath of sulphuric acid until the point of the glass rod just began to enter the gutta.

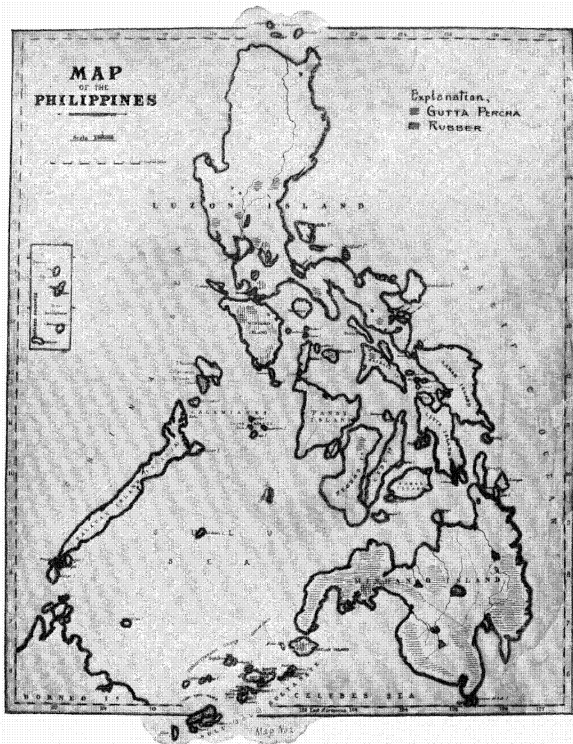
The tensile strength, or toughness, possessed by gutta, next to its resistance to sea water, is undoubtedly its greatest merit commercially. Even the inferior grades of gutta-percha are used for objects requiring toughness combined with pliability and strength. In the insulation of a submarine cable great toughness is imperative, for during the laying of the cable it is constantly subjected to great strains from kinking, pulling, rubbing, etc., and when it has reached the ocean bottom, where the pressure is often three and a half tons to the square inch, it must not have sustained a fracture even as large as the diameter of a fine hair, for otherwise the moisture would slowly penetrate to the wires, the insulation would not be complete, and the cable would have to be pulled up and repaired.

In order that the measurements made might be within the limits of the instruments at hand, only small strands of gutta could be used for testing. To make these strands free from minute air bubbles was well-nigh impossible, in consequence of which the breaking was in most cases brought about by weakness due to this source. The figures, while thus only approximate, are below and not above the true values, and show clearly the enormous tensile strength of my samples. Obach gives a tensile strength of 5,000 pounds for the best gutta-percha, while for the gutta from it he found about 6,500 which closely corresponds to results given above. This also brings out most clearly the excellent quality of the best Philippine gutta-percha.

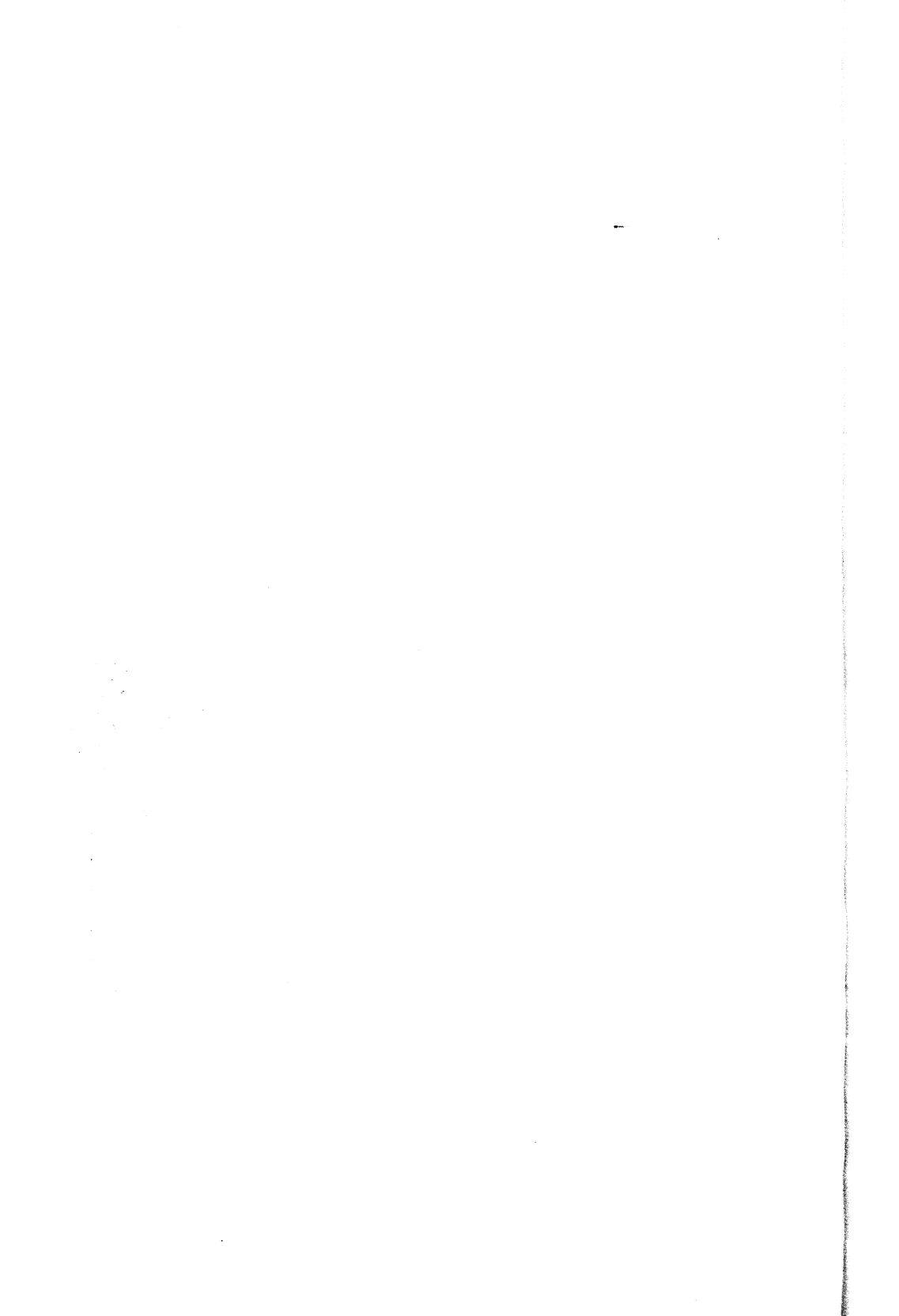
The results of the combined chemical and physical tests on various samples of so-called "guttas" extracted from gutta-perchas of different origin seem to show that the gutta from the gutta-percha of *Palauquium gutta* has certain well-defined chemical and physical properties. Also that some so-called gutta-perchas contain a substance which chemically resembles to a certain extent, the above-mentioned gutta, but differs widely from it in many of its physical properties. As the gutta from the species *Palauquium gutta* has stood the test of usage for fifty years it is only fair that its chemical and physical constants should be used as the standard of comparison. Until more is known chemically of such substances as I found in No. 10, a chemical analysis will not be sufficient to determine the value of a gutta-percha, but it must be supplemented by physical tests. This laboratory will undertake the task of so determining the chemical properties of gutta and its allied bodies in the hope of discovering a method of chemical analysis which alone can be used to determine the value of any gutta-percha.

SCIENTIFIC PROPAGATION.

As soon as the native collectors made such heavy inroads on gutta-percha forests as to make certain of their serious decimation, if not entire destruction, the various governments having tropical possessions in the East began to take note and make inquiries, but it was not until the last four or five years that the notes became serious or the inquiries anxious. Both explorations and inquiries revealed that the greater part of the Malay Peninsula had lost most of its trees, and that the portions of Sumatra and Borneo which were still productive were in the most inaccessible moun-

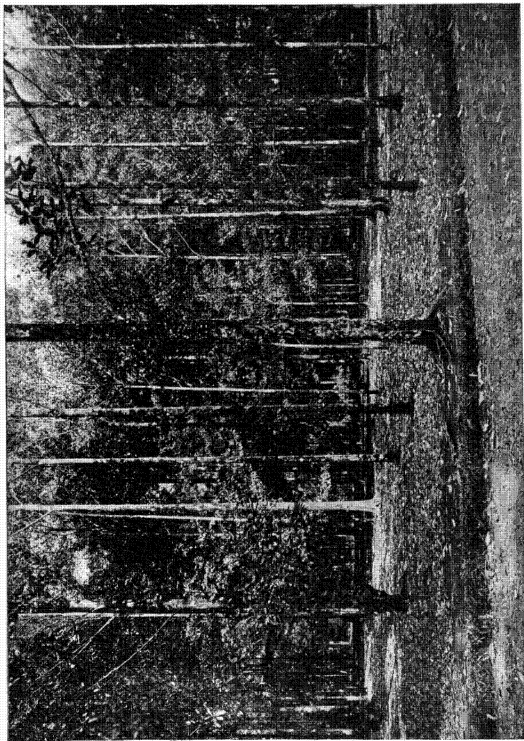


MAP SHOWING DISTRIBUTION OF RUBBER AND GUTTA-PERCHA.

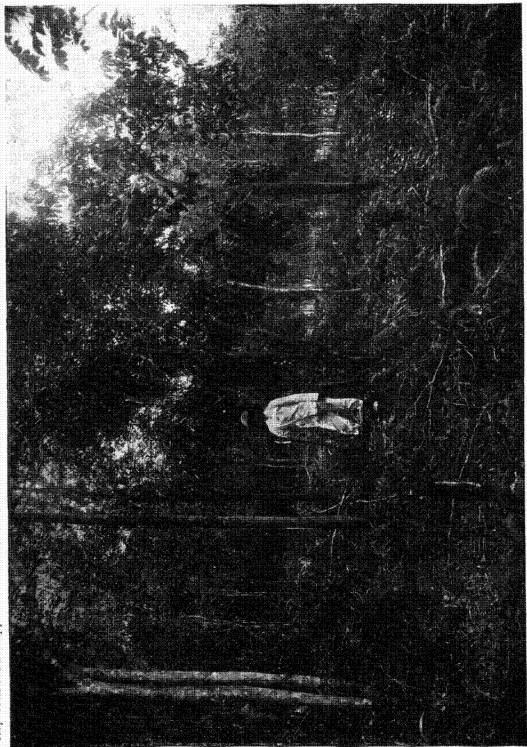




CHINESE TRADING BOAT COLLECTING GUTTA-PERCHA AT PARANG PARANG.



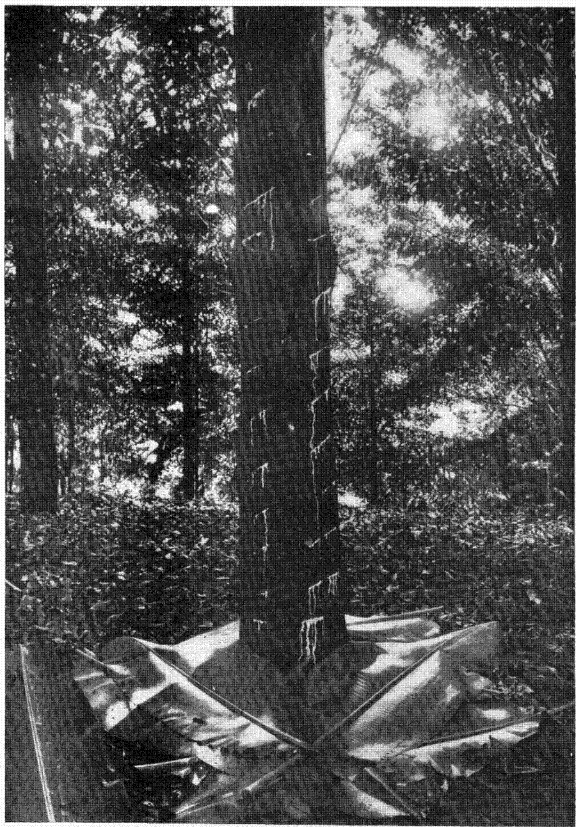
PLANTATION OF GUTTA-PERCHA TREES (PALAEQUIMUM GUTTA) OF VARIOUS AGES, BUITENZORG, JAVA.



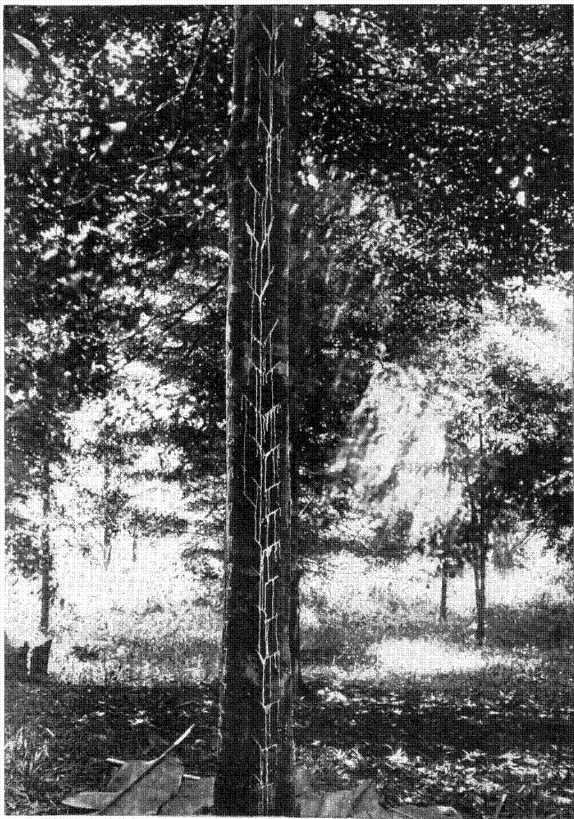
ENGLISH METHOD OF STARTING GUTTA-PERCHA PLANTATION, BUKIT TIMAH, SINGAPORE.



A PALAQUIUM GUTTA TREE GROWING IN THE OPEN, BOTANICAL GARDEN, SINGAPORE,
STRAITS SETTLEMENTS.



A TREE OF PALAQUIUM GUTTA JUST TAPPED, TJIPITIR, JAVA.



PALAEQUIM TREUBII JUST TAPPED, TJIPITIR, JAVA.



ABSENCE OF DEEP SCARS AFTER SEVERAL YEARS TAPPING, BUITENZORG, JAVA.

tain forests of the interior. So thoroughly had the seed-bearing trees been cleared out of the Malay States that a standing award by Government officials for seeds of the species *Palaequium gutta* were not claimed, though the offer stood for a long time. Von Romburgh, in a very extensive tour of Sumatra and Borneo, made for the purpose of reporting to the Dutch Government the condition of the gutta-percha regions, saw but a few seed-bearing trees, and these, in almost all cases, had been protected by native chiefs.

In the botanical gardens of Singapore, Bukit, Timah, Penang, and Buitenzorg, *Palaequium gutta* trees were growing which had either been protected from destruction or had been planted for a sufficient length of time to be seed-bearing. These formed the nucleus of the gutta-percha nurseries now being planted by the English and Dutch Governments, with the purpose of obtaining reliable information as to methods of propagation, the rapidity of growth, the time necessary for maturing, and above all to furnish material for testing scientific methods for extracting gutta-percha without killing the trees. Owing to the scarcity of seeds everywhere, the Government botanists were obliged to resort to various methods for securing young plants, and their experiments have been along the following lines:

I. *Planting from seeds.*—The fresh seeds are laid in beds of rich earth and allowed to germinate and grow under partial shade. When about a foot high they are transplanted to the future plantation, where the soil may be entirely free from trees, shrubs, or other vegetation (Dutch method) or where small patches of earth have been cleaned and loosened for their reception in a forest of secondary growth, heavy enough only to furnish a light shade (English method). By the Dutch method a light shade is required around each seedling until a vigorous growth is secured. The seedlings are set out about 5 by 5 yards apart, though where it is desired to obtain the largest amount of leaves per acre the space allotted is 4 by 4 yards. No special care seems necessary except to keep them free from weeds. Too much stress, however, can not be laid on the care which should be taken not to break or injure the long taproot of the young plant during the process of transplanting, for any injury to it stunts the growth materially or even causes death. Mr. Curtis, director of the Penang Botanical Gardens, has modified the manner of starting the germination and first growth, by placing each seed in a separate bamboo joint filled with earth. This joint is made long enough to allow the taproot to strike downward undisturbed, and when the time comes for transplanting it can be transferred, joint and all, without any fear of injury, to the place made ready for it. The bamboo is then cracked open and the plant inserted in the ground with almost no disturbance of its roots.

The Dutch Government in Java, having many seed-bearing trees, is now deeply engaged in carrying out a programme which contemplates the planting of some 150,000 seeds annually until at least 1,000,000 trees are growing. This will be done on extensive Government plantations at Tjipitir, Java. The entire management is intrusted to Doctor von Romburgh, director of the Government chemical laboratory at Buitenzorg, who has a corps of assistants intrusted with testing the gutta-percha contained in the seed-producing trees, in order that none but the best stock may be used.

II. *Planting from self-sown seedlings.*—In the forests both of Sumatra and Borneo the natives are still able to find comparatively large numbers of self-sown seedlings of the *Palaequium gutta* species. These, when carefully taken up and transplanted into air-tight boxes provided with glass covers and rich earth, can be packed in large numbers in a comparatively small space and shipped to almost any desired distance. For instance, 60,000 such seedlings were shipped two years ago from southern Borneo to the French Congo, via Antwerp. Those plants transported from Borneo to Singapore in this manner are doing well in the gardens there. The German Government is planning a nursery of such seedlings in the tropical possessions in Guinea.

III. *Slipping by means of marcottage.*—As neither direct slipping nor grafting has ever succeeded with gutta-percha trees, the method called marcottage was tried in Java and the Malay States with some success. This consists in selecting a young straight limb from a large tree, and at the point where the roots are to grow the bark is removed for the length of an inch around the entire limb. The denuded spot is then packed with rich mud which is held in by a coating of cocoanut or other fibers (see photograph). If the mud is kept moist, and only if this is the case can good results be secured, small roots will generally appear in three to nine months, when the limb can be cut off and planted.

The principal gutta-percha plantations now under cultivation and in which much useful and desired experimenting is being done, are located at Tjipitir and Buitenzorg in Java; on Rhio Island, at Singapore, and Bukit Timah on Singapore Island, on Penang Island, and at one or two places in the Federated Malay States. Enough time and work has been spent to demonstrate most conclusively that gutta-percha trees can be raised not only successfully, but also without much trouble or great outlay of money, and all the nations having tropical possessions in the East, except

the United States, have made a start toward gutta-percha plantations, but the Dutch are the only ones so far who have gone into it on a grand scale, and unless appearances are deceitful, they will have a monopoly on the plantation of the gutta-percha of the future as sure as they have on the forest gutta-percha of the present day.

SCIENTIFIC METHODS OF COLLECTING.

Modern methods of collecting gutta-percha have advanced along two lines. Needless to say they were not proposed nor carried out by the wild native collectors who are unwilling to discontinue present gains in favor of future returns. It was previously remarked that the gutta-percha is all contained in the bark of the tree and in the leaves. The problem resolved itself into either—

(1) Extracting some of the gutta-percha from the bark and leaves without injuring the tree, or

(2) Felling the tree and securing the gutta-percha from all of the bark and leaves.

To carry out the first proposition a method was devised similar to that used in South America for extracting rubber milk, by which incisions were made in the bark in a slanting direction up and down the trunk (see photograph fig. 40), so cut that the gutta-percha ducts were opened but no injury done to the inside wood of the tree. The milk flowed out to a greater or less extent and coagulated in strings on the bark. After the flow had ceased and complete coagulation set in (one day), the strings of gutta-percha were pulled off by hand, washed in hot water, and pressed into cakes. The advantage of this method was that no injury was done the tree although tapped repeatedly (see photograph, fig. 42.). The disadvantage lay in the fact that only a small per cent of the total gutta-percha in the tree could be extracted at any one time. According to Von Romburgh's latest experiments with plantation trees (*Palagium gutta*), about 15 to 17 years' old, the yield was 100 grams (nearly one-fifth pound) per tree. The gutta-percha thus secured was of the very best.

In addition to the amount thus taken the leaves, both from the living and dead trees, contain 8 to 10 per cent weight of gutta-percha calculated to the dry leaf. To extract this gutta-percha two processes have been devised.

(a) The mechanical one in which the leaf is ground to a powder and then treated with hot water in such a way that the gutta-percha is gradually worked into a compact mass, while the pulp of the leaf is washed away. Up to the present the process has not been perfected, for, although the gutta-percha obtained is of a good quality, the percentage of recovery is smaller than it should be. The largest factory of this kind is being erected near Singapore, and proposes to use the leaves from a plantation of 100,000 trees on the island of Rhio, some five hours from Singapore.

(b) The chemical process is carried out on the same lines as the mechanical one, so far as the grinding of the leaves is concerned. The powder is then extracted with solvents and the dissolved gutta-percha recovered either through precipitation or through evaporation of the solvent. The details of the process, as well as the solvents used, are kept secret and no patents for this or the mechanical process have been taken out.

The largest factory producing gutta-percha for the market is located at Sarawak, North Borneo, and is very advantageously situated as regards securing leaves from the surrounding gutta-percha forests. It has been claimed, however, that the factory defeated its avowed object of preventing the destruction of the trees, for the native collectors employed would never risk their lives trying to collect leaves from forest trees over 100 feet high, when they could gather them much easier by felling the tree and collecting a goodly amount of gutta-percha in addition. It thus appears that the supply of leaves must come from a plantation where supervision can be exercised.

The plan of felling the gutta-percha trees of the forest and securing all of the material from the bark and leaves is worthy of serious consideration. In the first place, the trees are surely doomed as long as present conditions obtain. If the native can sell the entire bark and leaves for more than he could get for the gutta-percha which he could extract, he will be tempted to bring them in. A second inducement for this method is the fact that many gutta-percha trees cut down even years previously have still much perfectly sound gutta-percha in the rotting bark, which could also be secured. The process of recovering the substance from the bark is practically the same as from the leaves, and about the same per cent is found there as well. With a yield of 10 to 15 times the present amount recovered from each tree, the gutta-percha market would be relieved at once, and the extermination of the trees put off many years, long enough at any rate to allow plantation trees to take their place.

A large amount of work has been done in the laboratory with the purpose of finding a practical method for extracting the gutta-percha from the bark and leaves of the gutta-percha trees. The process calls for a solvent for the gutta-percha which

will dissolve it easily, can be recovered and again used, and above all, has no deleterious effects on the substance.

The result of the experimentation led to a modification of the Obach hardening method for gutta-percha. The process consists in extracting the gutta-percha bark and leaves by means of hot gasoline, the apparatus being provided with reflux condensers. When the gutta-percha has entirely dissolved, the solution is allowed to stand until all of the dirt and most of the coloring matter has settled. The clear supernatant liquid is then poured off and cooled to 10° or 15° below freezing. The gutta, with a small amount of resin, is thereby precipitated, and can be filtered off through cloth bags and dried. The resulting gutta can be further precipitated by redissolving in distilled gasoline and reprecipitating. The filtrate containing the dissolved resins is redistilled, and the recovered gasoline used for effecting further solution of gutta-percha, thus making the process continuous.

The gutta so secured on being warmed can be pressed into any desired form for experimentation. The gutta used in the above experiments was so prepared, and the results of their physical and chemical tests showed them to be unaffected by the process to any appreciable extent. A year's exposure to laboratory fumes has not changed the substance in any way. The accompanying photograph (fig. 43) shows some of the pressed cakes prepared in the laboratory.

It is to be noted that the process gives practically pure gutta and not gutta-percha, the resins remaining dissolved in the gasoline. This is in itself a great advantage as the gutta could be used directly for bringing up the percentage in inferior grades of gutta-percha, and so make them suitable for cable insulation. The commercial value of this gutta has not been determined, but should be rated at about \$600 Mexican per picul, judging from the price of the best gutta-percha. In this way 3 piculs of Philippine gutta-percha, at \$210 Mexican, will produce 1 picul of pure gutta valued at \$600 Mexican, or a gain of \$390 for every 3 piculs of gutta-percha (or the equivalent in bark and leaves) handled.

PESTS AND PARASITES.

An instructive bulletin has been issued by Doctor Zimmerman, of the S'lands Plantation, at Buitenzorg, Java. His field of observation covered the large experimental gardens of Buitenzorg and at Tjipitir, where many thousands of gutta-percha trees of various species are now growing. While the same conditions do not obtain there as are encountered in the forest, it is certain that they are as badly if not worse off on account of the multitude of insects of all kinds which are attracted by the other plants of the gardens. In fact, he considers the test a severe one, and his conclusions that there are practically no insect pests that might be considered dangerous is very gratifying. Cattle and goats eat the leaves greedily, and young trees must therefore be protected until high enough to be out of reach.

PART 2.—RUBBER.

HISTORICAL AND DESCRIPTIVE.

Even the shortest outline presenting the subject of rubber in its historical, geographical, botanical, and commercial aspects would be beyond the scope of this report, nor does the part which the Philippines have taken in its production or are likely to take for several years to come warrant anything more than a brief explanation of the present state of the rubber industry in order to better understand the present conditions here and the future possibility of these islands becoming a new center of the ever-increasing rubber industry.

Rubber, or india rubber, as it seems best known in the United States, was discovered by the Spaniards in the second voyage of Columbus. The Indians of Haiti were found playing with rubber balls, which they said were formed from the hardened milk of certain forest trees on the island. In 1755 Don José, King of Portugal, sent several pairs of his boots to South America to be coated with rubber milk. They must have been made satisfactorily waterproof, for the rubber industry has increased from that day to this.

Not alone was the valley of the Amazon found stocked with rubber trees and vines, but new species were discovered in Central America and Mexico as well. In 1798 rubber-producing vines and trees were encountered in southern Asia, later on in central Africa, and by the middle of the nineteenth century almost every tropical country of the world had been searched, and the search has not been in vain.

The number of genera and species—even the families representing the rubber plants—is very large, especially because the production is not confined to trees alone

nor to any one country, as is the case with gutta-percha, but includes a large number of vines as well, and its area of production is practically that of the tropical world. While rubber trees predominate in tropical America, Africa and Asia apparently draw their greatest supply from vines. Borneo especially is rich in them to the exclusion of trees. The Philippines were said to contain more trees than vines, but systematic search has so far revealed only vines.

Not until the middle of the last century were the manifold uses to which rubber could be applied well understood and the rubber industry thoroughly established. Statistics show that London imported in 1830 some 46,400 pounds of rubber, and by 1870 this had increased to the enormous amount of 15,211,800 pounds for that one year alone. Since then the consumption has steadily increased, the statistics reading by tons and not pounds, and for 1902 amounted to some 62,650 long tons. London, the former chief center of the rubber trade, has retired in favor of New York. While tropical America in the beginning produced nine-tenths of the rubber supply, it now exports but very little more than one-half of the total amount, India, Burma, Borneo, and Central Africa especially having made giant strides in rubber production. Last year's production for the Malay States, Java, and Borneo was about 1,000 tons. In this was included the amount exported from the Philippines. How much that amount was there is no way of finding out, nor for how long this exportation of rubber has been going on. My investigations in the southern islands convinced me that whatever collecting and exporting has been done concerns the island of Tawi-tawi alone, and in all probability the amount was small. This conclusion is reached because only the natives of Tawi-tawi know of the commercial value of rubber, and also because I found rubber vines very near the coast of Tawi-tawi, a sure indication that the search for rubber has not been very careful nor for a long time.

The Philippine Islands are then practically a new field for the development of a rubber industry. It will be my purpose, therefore, to show—

(1) The species of rubber-producing plants indigenous to the islands and the amount of territory covered.

(2) The grade of rubber produced.

(3) The Philippines as a rubber producing country.

(a) Through utilization of natural supply.

(b) Through introduction of foreign species.

Reference to the photographs (figs. 45, 46, and 47) will show the two species of vines now known to be well distributed over the islands, both of which produce a good grade of rubber. Owing to my inability to find a vine in fruit or flower, one of them has not yet been determined botanically. Mr. Merrill contributes the following botanical description:

Parameria philippinensis Radlk (*Apocinaceæ*).—An evergreen woody vine, reaching a height of 40 or 50 feet, and a diameter of 1 inch or less. Bark gray, with an abundant milky sap. Leaves opposite, ovate, acute or somewhat acuminate, glabrous, 2 to 3 inches long; nerves four pairs; petioles short. Flowers small, white, fragrant, in terminal panicles. Fruit a long, slender, distantly torulose follicle, 10 to 12 inches long, the swellings over the seeds an inch apart. Seeds one-half of an inch long, brown, coma white, about twice as long as the seed.

Apocinaceæ (genus undetermined, specimen with leaves only, from the island of Basilan).—A very large vine 150 to 200 feet in length, with a diameter of 6 to 8 inches, the bark somewhat rough, greenish. Leaves broadly ovate or orbicular, abruptly very shortly acuminate, the acumen less than one-half inch long, 8 to 10 inches long, glabrous above, pubescent on the nerves beneath, the nerves prominent, about ten pairs.

It has already been stated that no rubber-producing trees have been found. That is to say a great many species of trees have been discovered which are known to produce a milk or latex, and while none so far studied contained rubber, it is scarcely to be supposed that when material from all has been collected, some at least will not be found to yield a good product.

The extent of territory covered by these two rubber vines is given by map No. 2. While the *Parameria* is found in Mindoro, Culion, and the other northern islands, the undetermined species was found on Tawi-tawi, Basilan, and Mindanao. The extent of territory covered in these various places was estimated after extensive personal investigations when all available data had been secured from natives, merchants, etc. In the northern islands, excepting Mindoro, the area covered is given as reported by those who found specimens of the vine. There is every reason to believe, however, that careful investigations would show much larger areas. In Mindoro the natives in all the coast towns knew the rubber vine "*Dactang ajas*" (medicine for snakes) and many of them brought us samples from the neighboring forest. They all reported large numbers of vines in the interior of the island, and

the three expeditions made there from the north, west, and south sides confirmed their statements.

In Mindanao the two areas given between Dinas and Tucuran, in the mountains near the south coast, are the only ones known so far, and even these were only found by accident. The natives knew nothing of rubber, but they had a vine which contained a milky substance, good either as a medicine or for making the heads of their drum sticks. On securing a piece of this peculiar substance from the latter it was found to be a good sample of rubber. Further explorations to the west and east will probably prove that this vine covers about the same area as that occupied by the gutta-percha trees.

In Basilan and Tawi-tawi the vine grows abundantly and to a large size. In the latter island the Moros understand its commercial value, and those engaged in collecting gutta-percha gather rubber at the same time, sometimes mixing the rubber and gutta milk.

THE GRADE OF RUBBER PRODUCED.

Rubber milk or latex is contained in the bark of certain vines and trees in exactly the same manner as is gutta-percha (see fig. 48). When made to flow the same phenomenon of coagulation apparently sets in quickly or slowly, according to the species of the plant. In many species of trees the coagulation is very slow and the flow of milk more abundant than with gutta-percha trees. As a result the natives have evolved the method of tapping the trees similar to that shown in fig. 49. The milk thus secured is coagulated in a manner similar to that employed with gutta-percha.

Another method which seems to give the best results, and which is employed in the preparation of Para rubber, consists in subjecting thin layers of the milk, placed on the broad end of a paddle, to the coagulating action of smoke produced by burning certain husks which are similar to those of cocoanuts. The smoke contains creosote and acid fumes, which quickly destroy all fungus growths and bacteria which might tend to cause decomposition of the rubber, while the heat removes the greater part of the moisture at the same time.

A chemical analysis of many grades of rubber coming from different species of trees and vines shows them, with the exception of variable amounts of water and dirt, to be composed almost entirely of rubber, with a small per cent of resins. The rubber in all has apparently the same chemical composition, an ultimate analysis giving the formula $C_{10}H_{16}$. Chemically, then, there appears to be only one rubber, while physically certain differences are to be found between samples from different species. Whether the superiority of Para rubber is due, therefore, to the excellency of the rubber itself or to the above-mentioned method of coagulation has not yet been determined. However, it is a fact that Para rubber from the tree species *Hevea brasiliensis* Mull. Arg. is recognized as the standard for grading rubber commercially.

It will be noted that the method before mentioned is one requiring skill, judgment, and the expenditure of considerable labor. In most rubber countries the native collectors possess none of these requisites and are content to employ the crudest methods. In consequence the rubber obtained is of a low grade, even though the species of tree is of the best.

The Philippine rubber collectors are Samal and Joloano Moros, living in Tawi-tawi and the adjacent coral islands. The method of coagulation used by them was undoubtedly learned from the Moros of north Borneo, who with the Dyaks collect much of the rubber in that island. It consists in first pulling the vine down to the ground so as to be better able to tap it along its entire length. The milk is caught in cocoanut shells or leaves, and coagulated by pouring into sea water. The coagulation is almost instantaneous, and when properly manipulated a large amount of water can be mechanically inclosed inside the large balls along with plenty of chopped-up bark. The resulting rubber, of which I secured many samples, is white, tough, and very elastic so long as it is kept in sea water. On exposure to the air it blackens, and decomposition slowly sets in.

The chemical analysis of a sample of this rubber, after much of the dirt and water had been removed, resulted as follows:

	Per cent.
Dirt.....	3. 76
Rubber.....	81. 57
Resins.....	3. 16
Water.....	11. 51

Judging from this analysis the rubber in Singapore would be rated as Borneo No. 1, which sells for \$125 Mexican per picul of 133 pounds.

The vines generally die after being pulled down and tapped, probably because of their inability to again reach light and sunshine.

The rubber from the Mindoro species has never apparently been gathered in any quantities even by the natives. When the bark is cut the milk flows readily and coagulates quickly. In appearance it is very similar to the Tawi-tawi rubber. As yet no chemical analysis has been made. In order to get a valuation of it a sample was submitted to the Goodyear Rubber Company, of Akron, Ohio, who placed it at about 60 cents per pound, after allowance is made for the percentage of water. Larger samples of both kinds of rubber are now being prepared in the laboratory in order that they may be submitted simultaneously to rubber experts.

THE PHILIPPINES AS A RUBBER-PRODUCING COUNTRY.

(a) *Thorough utilization of the natural supply.*—Judging from the way the natives of Tawi-tawi gathered rubber when left to their own devices I was convinced that they wasted as large amounts of the milk as they did when they collected gutta-percha—that is, ten to forty times more than they took away. It is evident then that under present conditions the history of the rubber vines will be the same as that of the gutta-percha trees, only on a smaller scale. It is useless, in my opinion, to think of tapping them only, for an inspection of their tortuous windings up and around the high forest trees (see fig. 50) will show the impossibility of ever collecting the milk, no matter how carefully the tapping were done.

To get the full value from the vine the rubber must be extracted from the entire bark. Experiments along that line are now in progress in the laboratory and so far promise well. If the entire vine be cut into pieces and dried, the bark easily separates from the wood and forms 44 per cent of the entire plant. By grinding the bark in any ordinary mill the rubber separates in the form of small balls while the bark passes off as powder. The dried bark contains 9 to 10 per cent by weight of pure rubber (see fig. 48), which shows this substance to be about 4 per cent of the entire vine. The other conditions and details will be investigated by the laboratory with a view of determining methods which will make possible the investment of American capital.

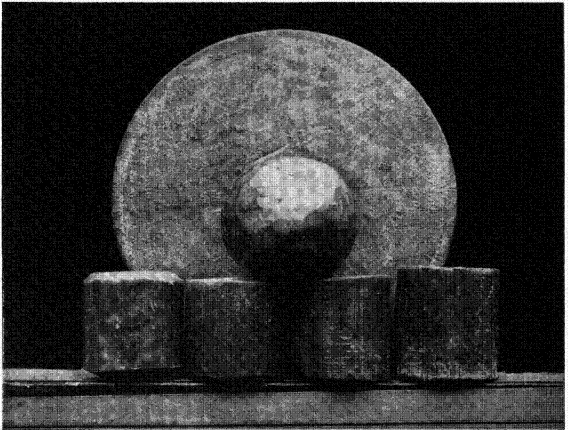
It is true that the method of collecting rubber given above kills the vine. The answer to this objection is found in the fact that when the vine has been cut-off the roots stool again quickly. On a hillside in Mindoro, where the natives had burned the forest for the purpose of planting rice, scores of stools from rubber vines were counted while the fire was yet smoldering in some of the old stumps and roots of the large trees.

(b) *Through introduction of foreign species of rubber trees.*—It was stated previously that no rubber trees were found in the islands. Exception should be made to the beautiful specimens of the india-rubber tree (*Ficus elastica* Linn.) which were introduced throughout the archipelago by the Spanish years ago as ornamental shade trees rather than as rubber producers. They are excellent examples of the way foreign species of rubber trees will grow here, and may also serve the still better purpose, that of furnishing seeds and slips to start rubber plantations. Many plantations of this tree have been begun in Java, the reasons for the selection of this species being: (1) The seeds are numerous and the plants will grow. (2) The method of starting new plants by marcottage (see fig. 38) succeeds very well and the plants have vigorous growth (see fig. 51). (3) The method of coagulation best suited for this milk is the simplest of all. It consists of making many small cuts in the bark of the trunk and allowing the outflowing milk to coagulate in strings. When dry and hard they are pulled off and pressed into a compact mass (see mass of rubber on the left, fig. 52) for shipment. The work can be done by even ignorant workmen and with no damage to the tree.

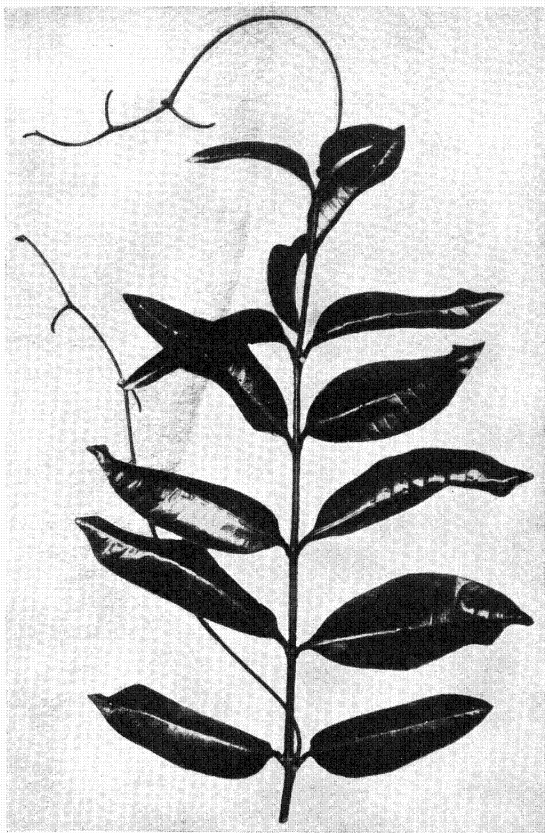
In the Malay States a great many plantations are now being started with Para rubber trees, the seeds of which are secured from the various government botanical gardens as well as from private plantations (see fig. 54). One of this species of trees is now growing in Manila and apparently the climate is suitable. The bureau of agriculture has distributed many Ceara rubber seeds during the past year and the growth of the seedlings is marvelous.

In general the climatic conditions of most of the islands seem very favorable for the rubber industry. Mindoro and the southern islands especially are advantageous on account of the abundant rainfall distributed throughout the year with no long season of drought.

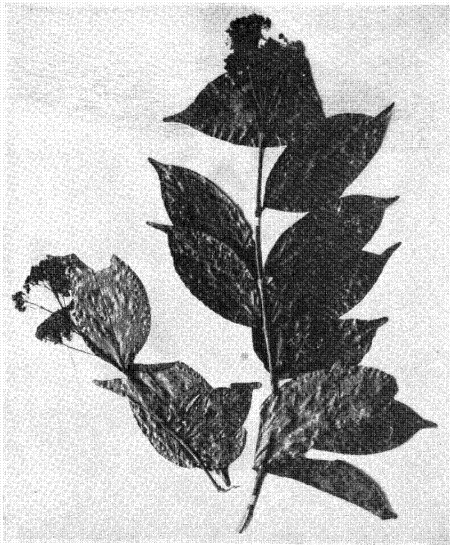
What pests and parasites the rubber trees would be troubled with can only be conjectured by reference to the experiences of Java, etc. Doctor Zimmerman extended his work on parasites to include rubber trees and has found one or two species of insects that may cause damage. Cattle and goats must also be guarded against.



SAMPLES OF PURE GUTTA PREPARED IN THE LABORATORY FOR EXPERIMENTAL PURPOSES.



RUBBER VINE (*WILLUGHBEIA FIRMA* BLUME). THIS SPECIES SUPPLIES MOST OF THE RUBBER PRODUCED IN BORNEO.

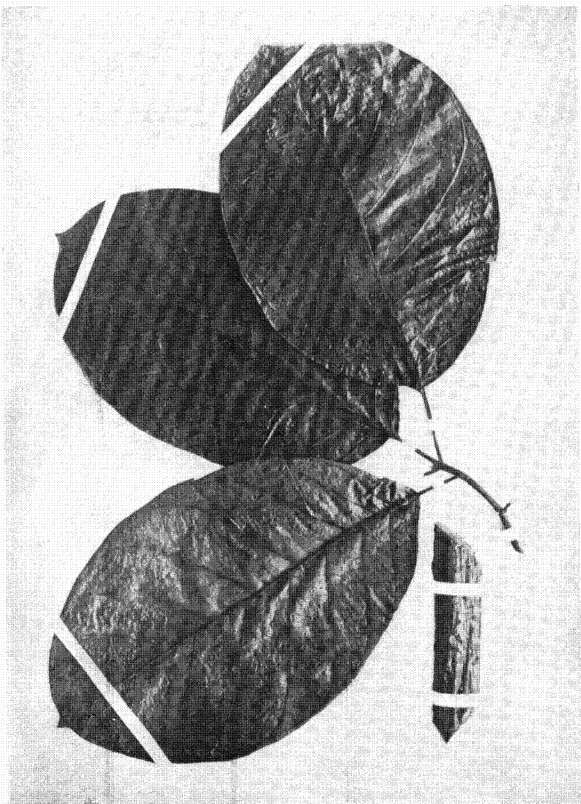


RUBBER VINE (*PARAMERIA PHILIPPINENSIS* RADLK.), GROWING IN GREAT ABUNDANCE ON ISLANDS OF MINDORO AND CULION.

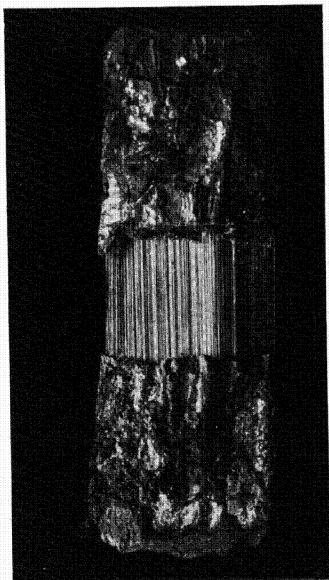


A RUBBER VINE (*PARAMERIS PHILIPPINENSIS* RADLK), WESTERN MINDORO.





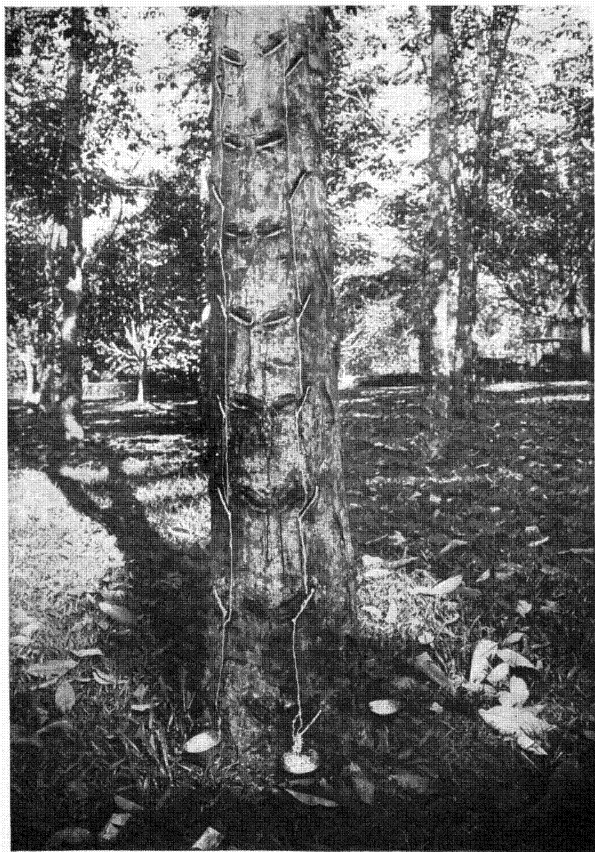
RUBBER VINE FOUND IN TAWI TAWI, BASILAN, AND MINDANAO. SPECIES UNDETERMINED.



PIECE OF DRY BARK FROM RUBBER VINE, SHOWING THE IMMENSE NUMBER OF RUBBER FIBERS IN THE INNER BARK.



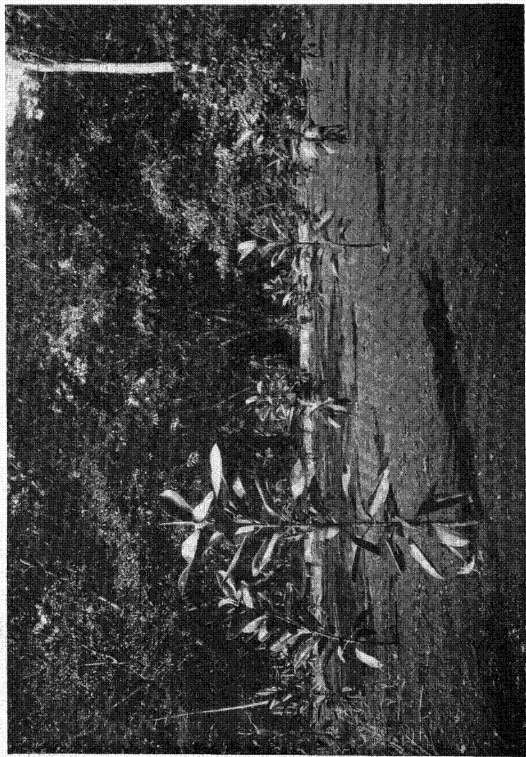
SHOWING METHOD OF PROPAGATING GUTTA-PERCHA TREES BY MEANS OF MARCOTTAGE, BUITENZORG, JAVA.



METHOD OF TAPPING A PARA RUBBER TREE THIRD DAY AFTER TAPPING, EXPERIMENTAL GARDEN, BUITENZORG, JAVA.



RUBBER VINE GROWING IN THE FOREST, WESTERN, MINDORO.



PLANTATION OF INDIA RUBBER TREES (*FICUS ELASTICA*), BUITENZORG, JAVA.

PARA RUBBER FROM THE WATERFALL GARDEN

SHOWING THE RESULT (3:11.0) OF THE FOURTH TIME TAPPING THE SAME TREE WITHIN
TWO YEARS AND THE QUANTITY OF RUBBER OBTAINED EACH MORNING

TOTAL AMOUNT IN 2 YEARS 12 1/2 LL.

III

IV

V

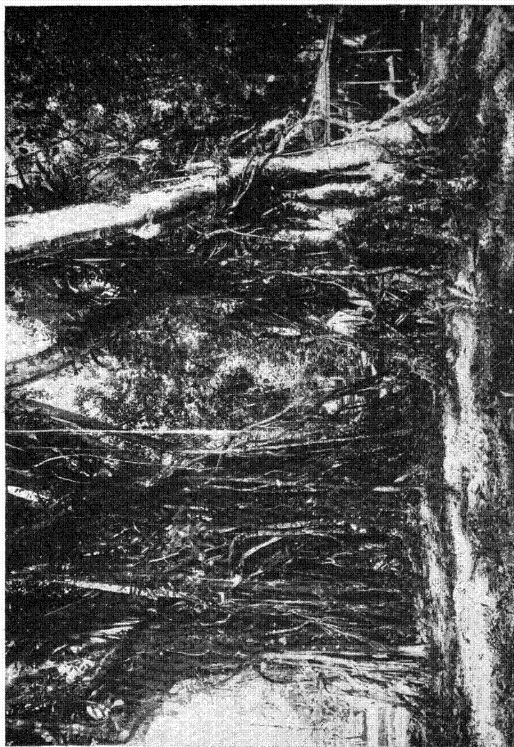
VI

VII

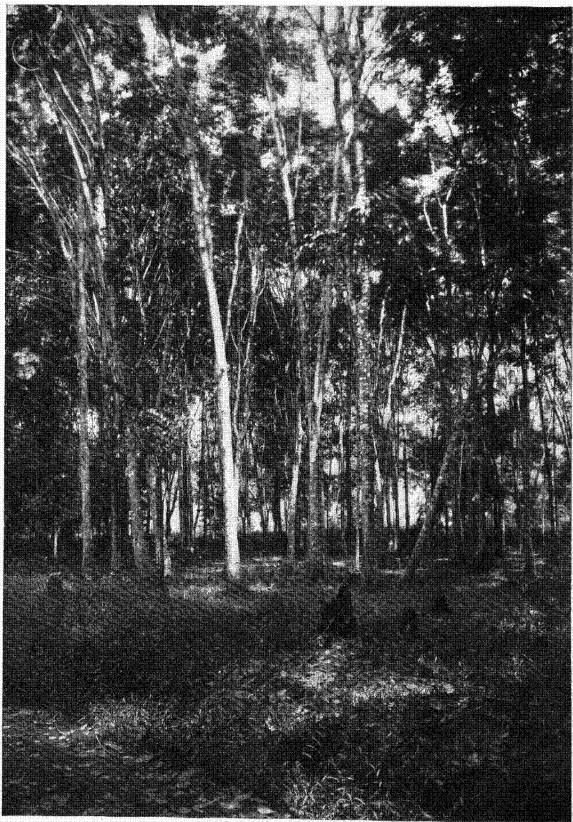
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GOVERNMENT GARDENS,
PERAK.

EXHIBITED BY
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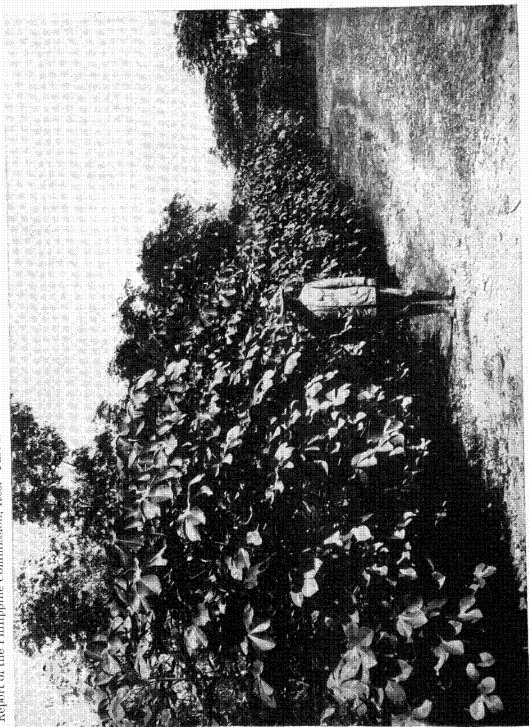
EXHIBIT OF PARA RUBBER, SHOWING YIELD OF TREES AND METHODS OF PREPARING FOR MARKET, PERAK PROVINCE, FEDERATED MALAY STATES.



LARGE INDIA RUBBER TREE (*FICUS ELASTICA* L.), BUITENZORG, JAVA.



PLANTATION OF PARA RUBBER TREES, PRODUCING SEED, BOTANICAL GARDEN, SINGAPORE.



CEARA RUBBER PLANTS, EXPERIMENT STATION, MALATE.

It is needless to dwell on the commercial side of rubber plantations. They are now flourishing in all tropical countries and as an agricultural investment are highly considered. However, in all new countries a certain amount of experimental work must be done before large capital can be safely invested. In India, Burmah, the Malay States, and Java this has been accomplished by the respective governments.

As soon as methods were perfected and seed supplies provided, private capital began operations at once. From the number of inquiries already made about rubber planting in these islands, it would look as if some movements in this direction are contemplated here, investors only waiting for the Government to pave the way. By profiting from the extensive experience of our neighboring countries the experimental era should be short and inexpensive, as a great deal of the pioneer work has been done.

EXHIBIT C.

REPORT OF DR. RICHARD P. STRONG, DIRECTOR OF THE BIOLOGICAL LABORATORY, COVERING THE PERIOD FROM AUGUST 31, 1902, TO AUGUST 31, 1903.

CLINICAL LABORATORY WORK FOR GOVERNMENT INSTITUTIONS AND FOR PRIVATE PHYSICIANS.

During the past year a greatly increased demand has been made upon the laboratory for clinical work, the total number of examinations performed from August 31, 1902, being 6,535, as against 3,816 for the previous year. Table No. VI will give an idea of the number and character of the specimens submitted for diagnosis. It is interesting to consider for a moment the tables showing the results of these analyses from a statistical point of view. Thus from No. VII it may be seen that in the study of the sputa of patients suspected to be tuberculous, 244 of whom were natives and 72 Caucasians, tubercle bacilli were found more than four times as frequently in the former as in the latter. The great number of examinations of sputa for natives suspected to be phthisical in excess of that performed for white people also suggests the more extensive prevalence of pulmonary tuberculosis among the former. From the same table it is evident that at least 1.2 per cent of the inmates of Bilibid Prison are suffering with phthisis, tubercle bacilli having been isolated from 31 cases. On the other hand, Table No. VIII might lead us to conclude that the white race is more susceptible than the native to typhoid and malarial fevers; however, comparatively few cases of either of these diseases have occurred during the past year either in government institutions or indeed in the city as a whole.

Table No. VI shows that, in spite of the continuous effort to diminish the number of cases affected with gonorrhea, 1,581 bacteriological examinations of prostitutes have shown infection with the disease during the year, this number being 37 per cent of the total number of examinations (4,269). However, if we consider the statistics of cases encountered during the past three months, we find that less than 33 per cent of those examined are diseased. During the previous year, out of 1,142 prostitutes, 447, or about 39 per cent of the total number, were found to be infected. These figures demonstrate with striking force how important and necessary it is that we continue our efforts to restrict, or if possible to suppress, this great scourge in the city of Manila.

Table No. IX gives one some idea of the intestinal parasitic diseases prevailing in the islands and of the proportion of amebic dysentery to other intestinal maladies, the former comprising at least one-sixth of the total number of such enteric diseases. These figures, however, may in one respect be somewhat misleading, as many of the specimens of feces from cases of intestinal disorders sent to the laboratory for examination have been unfavorable for the observation of amebæ, owing to the fact that the specimens were either too old or mixed with substances deleterious to sarkodina. From these facts, therefore, and particularly from clinical studies previously made, it seems more than likely that amebic dysentery constitutes considerably over one-sixth of all intestinal disturbances in and near this city. Uncinariasis apparently ranks next to dysentery in prevalence.

TABLE No. VI.—*Clinical laboratory examinations.*

	Civil Hospital.			Bilibid Prison.			San Lazaro Hospital.		
	P.	N.	T.	P.	N.	T.	P.	N.	T.
Sputum.....	20	76	96	31	169	200			
Urine.....			167						
Malaria, blood for.....	17	169	186	0	45	45			
Blood counts.....			246			2			
Serum reactions.....	5	63	68	0	1	1			
Gonococci.....	53	17	50				729	1,006	1,735
Feces.....			541			177			
Total.....			1,354			425			1,735

	Sampaloc district.			Private physicians.			Totals.		
	P.	N.	T.	P.	N.	T.	P.	N.	T.
Sputum.....				5	15	20	56	260	316
Urine.....						68			235
Malaria, blood for.....				4	7	11	21	221	242
Blood counts.....						11			259
Serum reactions.....				0	3	3	5	67	72
Gonococci.....	816	1,665	2,481	3	0	3	1,581	2,688	4,269
Feces.....						31			749
Pseudo farcy.....									5
Glanders.....									3
Surra.....							24	115	139
Necropsies.....									200
Miscellaneous.....									46
Total.....			2,481			147			6,585

P = examinations showing organisms (positive). N = examinations showing absence of organisms (negative). T = total.

TABLE No. VII.—*Microscopic examination of urine and sputum.*

		Native.		Foreign.	Total.	
		P.	N.	P.	P.	N.
Urine:						
Civil hospital.....		21	146		167	
Private physicians.....		40	28		68	
Total.....		61	174		235	

	Native.		Foreign.		Total.		Grand total.
	P.	N.	P.	N.	P.	N.	
Sputum for tuberculosis:							
Civil hospital.....	15	31	5	45	20	76	96
Bilibid prison.....	27	153	4	16	31	169	200
Private physicians.....	4	14	1	1	5	15	20
Total.....	46	198	10	62	56	260	316

TABLE No. VIII.—*Blood examinations.*

	Civil Hospital.						Bilibid Prison.					
	Native.			Foreign.			Native.			Foreign.		
	P.	N.	T.	P.	N.	T.	P.	N.	T.	P.	N.	T.
Hemoglobin.....						2			9			
Erythrocytes, count.....			9			55			1			
Erythrocytes, count difference.....			1			2						
Leucocytes, count.....			26			150			1			
Leucocytes, count difference.....			1			2						
Malaria.....			35			151			43			2
Tertian.....	2	33		5	146							
Estivo-autumnal.....	1	34		9	142							
Quartan.....		35			151							
Serum reactions:												
Typhoid fever.....		8	8	4	51	55		1	1			
Malta fever.....						3						
Dysentery.....				1	1	2						
Trypanosomiasis.....												
Total.....			80			420			55			2

	Private physicians.						Total.						Total.
	Native.			Foreign.			Native.			Foreign.			
	P.	N.	T.	P.	N.	T.	P.	N.	T.	P.	N.	T.	
Hemoglobin.....									9			2	11
Erythrocytes, count.....			1			1			11			56	67
Erythrocytes, count difference.....						1			1			3	4
Leucocytes, count.....			1			4			28			154	182
Leucocytes, count difference.....						3			1			5	6
Malaria.....			2			9			80			162	242
Tertian.....				4			2			9			
Estivo-autumnal.....													
Quartan.....													
Serum reactions:													
Typhoid fever.....		1	1		2	2		10	10	4	43	57	67
Malta fever.....												3	3
Dysentery.....										1	1	2	3
Trypanosomiasis.....													
Total.....			5			20			140			444	584

TABLE No. IX.—*Examination of feces.*

[(N.) Native. (F.) Foreign. Total feces examinations made: Native, 212; foreign, 537; total, 749.]

Parasites.	Civil Hospital.		Bilibid Prison.		Private physicians.		Total.		Per cent positive.	
	N.	F.	N.	F.	N.	F.	N.	F.	N.	F.
Amœbæ.....	2	70	51	3	1	5	54	78	25	14
Monads.....	4	61	13			10	17	71	8	13
Strongyloides intestinalis.....		1	1				1	1	.4	.2
Trich. dispar.....	6	23	5	1		3	11	27	.5	.5
Uncinaria.....	4	22	13			2	17	24	.8	.4
Ascaris lumb.....	4	3	4		1		9	3	.4	.5
Tœnia.....										
Balanitidium coli.....		2						2		.3
Megastoma enter.....		1						1		.2
Trichomonas and ascaris lumb.....	1						1		.4	
Trichomonas and uncinaria.....	1	2		3			1	5	.4	.9
Amœbæ and monads.....	2	10		3			2	13	.9	.2
Amœbæ, trichomonas, and uncinaria.....	2	2					2	2	.9	.3
Small amœbæ.....	1	14	2	2		1	3	17	.1	.3
Uncinaria and ascaris lumb.....		2		2		1		5		.9
Amœbæ, monads, and uncinaria.....		2	1	1			1	3	.4	.6
Trichomonas, monads, and uncinaria.....		2						2		.3
Amœbæ and uncinaria.....		1		3				4		.7
Monads and uncinaria.....		4				1		5		.9
Amœbæ, monads, uncinaria, and trichocephalus dispar.....		3		1				4		.7
Small and large amœbæ.....	1	2		1		1	1	4	.4	.7

Figures given are those found positive.

TABLE NO. X.—*Necropsies.*

	Native.
Plague:	
Septicæmic	12
Bubonic	71
Pulmonic	10
Cholera	63
Beriberi	2
Smallpox	1
Leprosy	2
Malta fever	1
Dysentery	5
Miscellaneous	39
Total	206

OTHER ROUTINE WORK.

In addition to the clinical laboratory work there have been performed for the board of health 206 necropsies for the diagnosis of contagious and infectious diseases, a number of examinations for the diagnosis of animal diseases, such as surra, glanders, pseudofarcy, hemorrhagic septicæmia, etc., and analyses of potable and mineral waters (many of which have been condemned as a result), as well as a considerable number of miscellaneous examinations.

The examination of rats for infection with *Bacillus pestis bubonicæ* has been continued by the laboratory during the year. Out of 1,623 rats examined, one-sixteenth of 1 per cent were found to be infected with this organism, as compared with 0.34 per cent during the previous year. The value and importance of these examinations were explained in the report for the year 1902. During the past year the laboratory has encountered 98 fatal cases of plague, 71 of which were of the bubonic type, 12 of the septicæmic, and 10 of the pulmonic. About one-third of these occurred in women, the ages of the victims varying from 2 to 72 years. There have been 75 autopsies performed upon cases of Asiatic cholera, one-third of which were upon females. It has not been thought advisable to give here the detailed statistics of the anatomical lesions found in the plague and cholera necropsies.

BACTERIOLOGIC EXAMINATIONS OF WATER.

During the year, as already stated, numerous bacteriologic analyses of drinking water have been performed. In a large number of wells examined 4 showed the presence of *Spirillum cholerae asiaticæ*, and as a result of these examinations the wells in question were promptly closed by the board of health. In several other cases well waters have been condemned as unfit for drinking purposes, either on account of the presence of excessive numbers of bacteria or because they contained organisms of the colon typhoid group.

The question of the quality of the drinking water used in the city of Manila has always been an important one. In my report of the previous year I called attention to the fact that this water frequently showed the presence of varieties of *Sarkodina* and *Mastigophora*, demonstrating how unsafe it was for drinking purposes until it had been thoroughly boiled or filtered. At certain periods of the year this water, even from a bacteriological standpoint, is far from what should be desired. Probably the majority of the white population of Manila avoid using it unless it has been boiled, filtered or distilled. The practice of many, as is well known, is to obtain their daily supply of water from some distilling plant, or to boil the city water, afterwards placing it in receptacles on ice. As it is often a difficult matter to keep these receptacles sterile, on account of the carelessness or ignorance of those (usually servants) who attend to them, the water in one way or another becomes infected in a great many cases, so that at the end of from twelve to twenty-four hours it is no longer fit to drink, either from the fact that it contains an excessive number of bacteria or because amebæ are present in such large numbers as to be visible simply upon microscopic examination. With a view to furnishing the public with some safe means of preparing drinking water, and in particular for those who are obliged to travel in the provinces where at times it is difficult to obtain pure water, it was thought advisable to undertake experiments in order to find some simple and practical method of sterilizing water with chemical substances.

The following report of Dr. W. B. Wherry, pathologist in this laboratory, seems to demonstrate that benzoyl-acetyl peroxide is valuable in the sterilization of drinking water against bacteria under certain conditions. This report is herewith submitted.

THE USE OF ACETOZONE (BENZOYL-ACETYL PEROXIDE) IN THE STERILIZATION OF WATER FOR DRINKING PURPOSES.

(Dr. W. B. Wherry, pathologist, biological laboratory.)

The following experiments were performed to determine a safe and yet sufficiently small amount of acetozone necessary to render Manila tap water fit for drinking purposes:

The method employed was that commonly used, viz, adding a known quantity of the germicide to a definite quantity of water, allowing it to act for a definite period, plating a constant quantity of the mixture, and counting the colonies. Control plates of tap water were made in each case.

In certain instances where growth resulted the general character of the organisms, with reference to whether they were spore forming or not, was determined after forty-eight hours by microscopical examination. A 1:1,000 solution of acetozone, prepared every morning, was used each day. Control counts showed the presence of between 100 and 300 bacteria per cubic centimeter.

As shown by Table XI, acetozone added to tap water in the strength of 1:10,000, 1:30,000 and 1:60,000, destroyed the majority of the organisms present. Those surviving its action were chiefly molds, spore, forming organisms of the bacillus subtilis type, and a few cocci. Its action was more marked in five minutes than in one.

TABLE XI.

Character of colonies.	Amount of acetozone present.	Amount of water plated.	Time of action in minutes.	Number of colonies present in—	
				24 hours.	48 hours.
Spore-bearing bacilli and molds	1:10,000	c. c.	1	14	17
	1:10,000		3	4	10
	1:10,000		5	6	9
Spore-bearing bacilli and a few cocci	1:30,000	1	1	4	5
	1:30,000	1	3	6	9
	1:30,000	1	5	1	4
Spore-bearing bacilli and molds	1:60,000	1	1	Many.	(a)
	1:60,000	1	3	4	8
	1:60,000	1	5	6	9
Do.....	1:10,000	1	1	2	2
	1:10,000	1	3	5	15
	1:10,000	1	5	1	4
Spore-bearing bacilli.....	1:30,000	1	1	3	(a)
	1:30,000	1	3	8	8
	1:30,000	1	10	4	8
Do.....	1:60,000	1	1	7	(a)
	1:60,000	1	3	4	(a)
	1:60,000	1	5	1	1
	1:60,000	1	30	2	2

a Overgrown.

In order to determine more definitely its action on such nonspored organisms as *B. typhosus*, *B. dysenteriae*, and *Sp. cholerae asiaticæ*, which have about the same powers of resistance to destructive agencies, a further test was made.

Three hundred cubic centimeters of tap water was placed in each of two clean flasks and sterilized in the autoclave at 135° C. When cool 1 cubic centimeter of a 20-hour old culture of *B. typhosus* in bouillon was added to each flask in the proportion of 1:30,000 and 1:60,000, respectively. One cubic centimeter of this emulsion was plated in agar melted and cooled to 40° to 50° C. at intervals of five, ten, and thirty minutes.

TABLE XII.—Tap water (autoclaved) 300 c. c. to 1 c. c. 24-hour *B. typhosus* in bouillon.

Amount of water plated.	Amount of acetozone present.	Time of action in minutes.	Number of colonies in—	
			24 hours.	48 hours.
c. c.	1	5		
	1	10		
	1	5	1 (div)	1 (do.)
	1	10		
	1	30		
	1		Innumerable.	

Table XII shows that 1/300 c. c. of the emulsion contained innumerable typhoid bacilli and that the acetozone produced complete sterilization in five minutes.

A 1:60000 solution of acetozone is tasteless, and it is recommended that it be employed, in a fresh condition, at about this strength (16 c. c. of a 1:1000 solution per liter of water) and that it be permitted to stand fifteen minutes to half an hour before use.

This work is confirmatory of that performed by Dr. P. G. Novy, of the University of Michigan, on the value of acetozone as a disinfectant.

Dr. W. E. Musgrave is now undertaking experiments to determine the strength of a solution of acetozone necessary to kill the variety of amœbæ cultivated from the city water supply.

The following experiments of Dr. P. G. Wooley of this laboratory relating to the action of citric acid on the cholera spirilla found in drinking water are of interest:

THE ACTION OF CITRIC ACID ON THE SPIRILLUM OF ASIATIC CHOLERA.

(Dr. P. G. Wooley.)

In the following communication are reported some experiments made with pure cultures of the spirillum of Asiatic cholera isolated from the intestines of persons dead of the disease. This work was stimulated by the fact that the growth of the organism of Asiatic cholera is inhibited by the presence of acid in the medium upon which the organism is planted, and by the desire to find a safe and palatable substance which can be added to water to render it safe for drinking purposes, at least so far as cholera is concerned.

For the first series of experiments a 2 per cent solution of pure citric acid was used. This was added to tubes of 2 per cent peptone in the proportion of 1, 2, 3, 4, 5, and 6 c. c. to each 10 c. c. of peptone solution. To each of these mixtures was added a loopful of a twenty-four hour old culture of the spirilla of Asiatic cholera, and from each of these agar plates were made at the end of ten and twenty minutes.

I.

	Peptone.	2 per cent citric acid.	Number minutes.	Number colonies.
Tube I	c. c. 10	c. c. 1	10 20	3
Tube II	10	2	10 20	3
Tube III	10	3	10 20	.....
Tube IV	10	4	10 20	.....
Tube V	10	5	10 20	Many.
Tube VI	10	6	10 20	.....
Control	10	.....	10 20	Countless. Countless.

After twenty-four hours no motile organisms were found in any except the control, which was the only one that produced the "cholera red" reaction.

A second series of experiments was made with the same solution, but with greater precautions, and the results were as follows:

II.

	Peptone.	2 per cent citric acid.	Number minutes.	Number colonies.
Tube I	c. c. 10	c. c. 2	10 20	.....
Tube II	10	4	10 20	.....
Tube III	10	6	10 20	.....
Tube IV	10	8	10 20	.....
Tube V	10	10	10 20	.....
Control	(a)	.....	10 20	Countless. Countless.

a Plain peptone solution.

At the end of twenty-hours the fluid in the tubes was clear and no motile organisms were seen. The contents of the control were cloudy and gave the "cholera red" reaction.

A third series was as follows:

III.

	2 per cent peptone.	2 per cent citric acid.	Number minutes.	Number colonies.
	<i>c. c.</i>	<i>c. c.</i>		
Tube I	10	2	10 20	1
Tube II	10	4	10 20	1
Tube III	10	6	10 20	..........
Tube IV	10	8	10 20	2
Tube V	10	10	10 20	..........
Control	(a)	.....	10 20	Countless. Countless.

^a Plain peptone solution.

The colonies from Tube I were those of a coccus, from Tube II of a large bacillus, and from Tube IV of a large spore-bearing bacillus. The fluid in all the tubes is clear at the end of twenty-four hours, while the control was cloudy and gave the "cholera red" reaction.

A fourth series was next undertaken to discover the efficacy of lemon juice as a disinfectant. The amount of citric acid in the foregoing experiments was so small that it seemed natural to suppose that lemon juice would act satisfactorily if employed in the proper amount and yet in a solution sufficiently dilute to be palatable and harmless.

With these points in view, the following tests were made with the pure juice expressed from large fresh lemons:

	2 per cent peptone.	Lemon juice.	Number minutes.	Number colonies.
	<i>c. c.</i>	<i>c. c.</i>		
Tube I	10	$\frac{1}{2}$	10	3
Tube II	10	$\frac{1}{2}$	10	3
Tube III	10	1	10	.....
Tube IV	10	2	10	.....
Tube V	10	3	10	.....
Control	(a)	.....	.....	Countless.

^a Plain 2 per cent peptone solution.

Indol reaction in the control was positive. Tubes IV and V remained clear until the end of sixty hours, when molds grew plentifully in them.

A final experiment was made to determine the value of the common lime sirup sold at drug stores under the name of "Jarabe de Limon:"

	2 per cent peptone.	Lime sirup.	Number minutes.	Number colonies.
	<i>c. c.</i>	<i>c. c.</i>		
Tube I	10	$\frac{1}{2}$	10	Countless.
Tube II	10	$\frac{1}{2}$	10	Countless.
Tube III	10	1	10	Countless.
Tube IV	10	2	10	300
Tube V	10	3	10	2
Control	(a)	.....	10	Countless.

^a Plain 2 per cent peptone solution.

Control gave the "cholera red" reaction at the end of twenty-four hours. All of the tubes except No. V were cloudy and showed motile spirilla.

The value of such experiments is, of course, not great, since it is not safe to trust to such chemical means of rendering bad water fit to drink, but the results are inter-

esting and of some possible value, especially in cases of emergency. The conclusion that we may draw from this is that water rendered so acid that the degree of acidity is equal to from one-half per cent to 1 per cent of citric acid is fairly safe so far as cholera is concerned.

We find from an analysis made in the laboratory that a large fine lemon contains 6.86 grams of crystallized citric acid per 100 c. c. The lemon used contained 40 c. c. of juice, which is equivalent to 2.744 grams of citric acid. At this rate half the juice of a lemon, the amount usually employed for a glass of lemonade, would be equivalent to 1.37 grams of citric acid.

RESEARCH WORK.

The time taken up by routine work, laboratory examinations for the diagnosis of human and animal diseases, analyses of waters, etc., has left but comparatively little time for research. However, special studies have been pursued by Dr. W. E. Musgrave and Mr. M. Clegg on surra, by Drs. P. G. Wooley and J. W. Jobling (the latter of the serum laboratory) on hemorrhagic septicaemia of animals, by Dr. W. B. Wherry on hand infection due to organisms resembling the Koch-Weeks bacillus, by Mr. Charles S. Banks on the insects of cacao, and by myself on protective inoculation against Asiatic cholera. These reports are appended.

On January 31, 1902, I was directed by the Civil Commission to proceed to Europe at my own expense for the purpose of making investigations into recent discoveries in biological science. In addition to the studies which I pursued in Germany, I visited the London School of Tropical Medicine, the German School of Tropical Medicine at Hamburg, the Pasteur Institute at Paris, and the Government civil hospitals at Port Said and at Colombo, Ceylon. Much valuable information was gained from these visits, and while engaged in them I paid particular attention to whatever advancement had been made in laboratory methods, technique, and apparatus, and by conversation and consultation with various men of science endeavored to obtain information with regard to advanced methods of dealing with future problems in tropical diseases.

At the Pasteur Institute in Paris, through the kindness of Professors Metchnikoff and Laveran, the work done at this institute on nagana, a disease very closely allied to if not identical to surra, was carefully gone over with me, Professor Laveran reviewing his specimens and studies upon this subject and offering suggestions for future lines of investigations.

At the tropical schools of medicine at London and Hamburg opportunities were presented for the observation of parasitic and other diseases, which hitherto have occurred more commonly in Africa, but which may from time to time find their way to the Philippine Islands.

During several days spent in observation at the London School of Tropical Medicine, I was invited by Sir Patrick Manson, K. C. M. G., F. R. S., to read a paper before the Epidemiological Society in connection with the question of the Panama Canal and its relation to the introduction of yellow fever into Asia. The object of this meeting, opened by Sir Patrick Manson, was to call attention to the work of the late Dr. Walter Reed and of his associates in relation to yellow fever, and to urge upon the Congress of the United States the importance of placing a medical man on the Panama Canal Commission for the purpose of bringing about proper sanitary conditions along the shores of the canal, and of ridding this region of the disease, as has already been done in Habana through the efforts of Wood and Gorgas, acting upon the observations of Walter Reed. As the subject is one of so great importance to the Philippine Islands, it has been thought advisable to call attention to it in this report in the article appended with the other special reports from the biological laboratory.

In Berlin, having obtained admission to the Königl. Institut für Infektionskrankheiten (Herr Geh. Med. Rath, Prof. Dr. R. Koch, director), through the courtesy of Profs. William H. Welch and William Osler, of Johns Hopkins University, and Profs. C. A. Ewald and A. Wassermann, of the University of Berlin, I took up my special work in immunity in the department of Professor Wassermann, and as an outcome of some of these studies the report on the production of a cholera vaccine is submitted. In addition to these bacteriological researches, daily work was performed in the pathological laboratory of either the Charité or the Augusta Hospital.

I arrived in Manila on July 13, and resumed my duties as director of the biological laboratory.

The special reports from the biological laboratory are appended.

REPORT ON TRYPANOSOMA AND TRYPANOSOMIASIS, WITH SPECIAL REFERENCE TO SURRA, IN THE PHILIPPINE ISLANDS, BY W. E. MUSGRAVE, M. D., AND MOSES T. CLEGG.

INTRODUCTION.

Before entering upon a discussion of the text of this report a few remarks regarding the facilities at our disposal appear advisable.

Fig. 3 illustrates a specially constructed insect-proof stable in which all experiments necessitating extraordinary precaution were performed. To obtain satisfactory results such a structure is an absolute necessity. This stable is screened on all sides, the stalls are separated by wire netting, and each is provided with a door of the same kind. On each side there is an additional hall entirely screened and with a single outside door. At one end an insect-proof operating room was built and provided with a protected entrance to the different stalls.

Because of these precautions experiments have been conducted by us with an absolute certainty of results, and owing to a lack of facilities similar to ours many of the conclusions contained in reports relating especially to the transmission of the disease do not appear to have been based upon accurate observations.

Discussions of the transmission of the disease by feeding, based upon observations made without protecting animals from insects, do not, of course, lead to a final settlement of the question; and so with many other conclusions in the voluminous literature relating to this subject.

In reviewing literature we have tried in each instance to give credit to the person to whom due, but in this we may sometimes have failed. The works of Voges, Lingard, Kanthuck, Durham and Bradford, Laveran and Mesnill, Rabinowitch and Kempner, Wasielewski and Senn, and many others have been freely used.

DEFINITION.

The disease is a specific infection of many of the lower animals, and occasionally of man, caused by *Trypanosoma*. It occurs in epidemic form over large areas of tropical countries, and is usually more severe during the rainy season. It is characterized by a period of incubation followed, in most animals, by a remittent, intermittent, or less frequently relapsing fever; by the presence of *Trypanosoma* in the circulating blood, which in some animals are numerous in proportion to the temperature, by progressive anemia and emaciation, by a catarrhal condition of the mucous membranes of the eyes and nose, by roughness of the hair, which in many instances falls out, by subcutaneous edema, more commonly of the posterior extremities, genitals, and belly. In the latter stages paresis of the posterior extremities is very common. The mortality among most animals of economic importance is 100 per cent.

There are found in most animals at post-mortem, in addition to the evidence of severe anemia, certain changes in the spleen, the most constant being enlargement and a peculiar mottling. Taken with other principal lesions, such as lymphatic hyperplasia, peculiar, yellowish, gelatinous, subcutaneous and subserous infiltrations, an enlarged liver, and the accumulation of fluid in the serous cavities, it makes an anatomic picture which is rarely excelled in chronic diseases peculiar to man.

NOMENCLATURE AND CLASSIFICATION.

A list of the various names used to designate trypanosomiasis in different parts of the world has been compiled from literature as follows:

Adjoe.	Equine surra.	Mal de caderas.
Andar-tap.	Equine syphilis.	Maladie á trypanosome.
Anémie pernicieuse.	Exanthème coitale.	Maladie benigne du coit.
Berbad.	Fish surra.	Maladie de la tsésé.
Beschalkrankheit.	Flagellose de equins.	Maladie de Soemedang.
Beschalseuche.	Galtah.	Maladie du coit.
Blaschemausschlag.	Galtia.	Maladie du prurit.
Bovine surra.	Glossinose.	Maladie vénérienne du
Buffalo surra.	Horse pox.	cheval.
Camel surra.	Horse surra.	Marri.
Canine surra.	Juckkrankheit.	Nagana.
Dog surra.	Kanhog.	Nikalgaya.
Doaia.	Khusk-zaharbad.	N'gana.
Dourine.	La mouche.	Nygana.
Equine relapsing fever.	Leuma equorum.	Oae.

Pernicious anemia of horses.	Purana.	Tarai.
Peste de cadeiras.	Rat surra.	Tebersa.
Pferdestaupe.	Relapsing fever of equines.	Tibarsa.
Phenta.	Sar.	Trypanosomose.
Phenta-ka-darad.	Sara.	Tsétscé fly disease.
Phera.	Schleichende Fieber.	Tsétscékrankheit.
Pheta.	Sokra.	Tumby-a.
Phetra.	Sukal.	Tumby-baba.
Phitgaya.	Surra.	Wabai-ki-bokhar.
Photra.	Surra american.	Zaharbad.
Polynevrite infectieuse du cheval.	Surrakrankheit.	Zherbad.
Poona.	Tap.	Zucht lähme.
	Tap-dik.	
	Tap-dik.	

In this report the term "trypanosomiasis," as suggested by Salmon and Stiles, is used, being in a general sense comparable to the terms "filariasis" and "uncinariasis." Following this classification further, according to the animal infected, we would have trypanosomiasis of man, trypanosomiasis of horses, trypanosomiasis of cattle, etc. Such a nomenclature would apply satisfactorily, whether the infecting parasites are identical or not, and also regardless of the manner and place of infection. For example, the term trypanosomiasis of horses would apply equally well to nagana contracted by the bite of an infected tsétscé-fly in South Africa, and to surra produced by the hypodermic injection of infected trypanosomatic blood in Manila.

If the parasites causing the diseases known under the old names have been or are shown to be different, there could be no very great necessity for interfering with the better part of the established nomenclature. Surra would then be the trypanosomiasis of horses and of other animals due to an infection with *Tr. evansi*; nagana would be the trypanosomiasis of horses and of other animals due to an infection with *Tr. brucei*, etc.

On the other hand, if these parasites are shown to be the same, or probably more correctly until they are shown to be different, there does not appear any valid reason why any of the names, except that of surra, accepted by Evans, the original discoverer of the pathogenicity of the parasite in animals, should be retained.

Without entering in detail upon a discussion, which will be taken up later in the report, regarding the identity or nonidentity of *Tr. evansi*, *Tr. brucei*, *Tr. rougetii* (equiperdum), and *Tr. elmassianii* (equinum), and hence the identity or nonidentity of surra, nagana, dourine, and mal de caderas, there is considerable difference of opinion, and also considerable inconsistency in some of the writings, especially with reference to the diseases discovered and named since Evans's original report.

Numerous writers on trypanosomiasis base their diagnoses on the presence of *Tr. brucei*, and, after carefully describing the parasite, state that they do not know whether or not it is identical with *Tr. evansi*. How can such writers, not having previously studied either of the parasites, state that it was not *Tr. evansi* rather than *Tr. brucei* they were working with. If they are positive that the parasite is *Tr. brucei* then they affirm it to be different from *Tr. evansi*. It is obvious that if these parasites are identical *Tr. brucei* is not entitled to a place in the nomenclature of trypanosoma, for *Tr. evansi* was known and described years before Bruce performed his work. Bruce himself, in his original report, considered his parasite probably identical with *Tr. evansi*.

Some eminent authorities criticise Koch and many other writers for stating that *Tr. evansi* and *Tr. brucei* are identical without offering detailed proof of their statements. Such criticism seems to us unjust. The proof demanded is that they are different parasites, and until this proof is furnished, writers, in our opinion, are perfectly entitled to consider the trypanosomiasis of horses and a number of other animals as being due to an infection with *Tr. evansi*.

The practical importance of deciding this question is forcibly brought home to workers in the Philippine epidemic, a fact which has already been emphasized by other writers. We have to deal with an extensive epidemic of trypanosomiasis in several species of domestic animals, particularly in the horse, and the parasite causing the disease seems to be the same in all. This parasite answers the description given of *Tr. evansi*, *Tr. brucei*, and others, and it is necessary either to introduce a new name or to classify from description. We have decided, after a careful review of all available literature pertaining to the subject, that we are dealing with *Tr. evansi*, redescribed by Bruce as the causative agent in nagana and named *Tr. brucei* by Buffard and Schneider, and also described and given other names by various authors. To be consistent with this statement "surra" would be the only allowable popular

name for the disease caused by this parasite, the numerous other names becoming mere synonyms.

In those forms of the disease due to other species of trypanosoma other names would, of course, be allowable; but, with the possible exception of dourine, we have nowhere else met so much confusion and such a multiplication of names as is found in the group of which *Tr. evansii* is the cause.

HISTORIC.

Caladrini, according to Voges, in 1842 wrote letters describing a disease in South America which has subsequently been determined to be trypanosomiasis (mal de caderas) and since that time has been discussed under various names and by several authors.

Sivori and Lecler are satisfied that this disease existed in South America before 1850, while Lacerda states that mal de caderas was imported to the mainland about 1850 from Marajo, an island at the mouth of the Amazon River, and from there spread rapidly over Brazil, thence to Paraguay, probably about 1860, quickly covering almost this entire country and killing thousands of horses.

Dourine has been known in various places since the latter part of the eighteenth century, but curiously enough was one of the last varieties to have its etiology elucidated. In 1858 Livingstone wrote of the tsetse fly disease in Africa, at that time old and well known to the natives.

Surra was first brought prominently before the scientific world in a report published by G. Evans in 1880. He accurately described the disease, which had been known for generations to the natives of India, and proved the causative rôle of *Trypanosoma* in this infection. Since the publication of Evans's report a great deal has been written regarding trypanosomiasis, as a glance at the bibliography will show.

The disease annually destroys millions of dollars' worth of animals in India, Africa, and South America. Some of the more recently infected countries are the islands of Mauritius, Java, and the Philippines.

The island of Mauritius was free from trypanosomiasis up to the South African war, but during that conflict many animals from infected countries were sent into Africa and some of them found their way into this island. A severe epidemic developed, destroying so many of the animals that the planting and gathering of crops became an impossibility.

In 1900 surra broke out among the cattle, carabao, and horses of Java, since which time it has there been endemic. As soon as the disease was discovered in Java vigorous plans to prevent its spread were instituted, and with marked success, if the small losses of that country are compared with the frightful havoc among horses and cattle which have been reported from other infected regions.

In 1886 Biguami and Celli mentioned a parasite resembling *Tr. lewisi*, which they found in the blood of a patient suffering from malarial fever. Nepveu, in 1898, reported the presence of *Trypanosoma* in the blood of seven patients, six of whom were suffering from malaria and the seventh was healthy. He described and illustrated the parasite. During 1902 Dutton, Forde, and Manson reported *Trypanosoma* in human beings, and in 1903 Manson and others have reported a number of cases.

The first published report which we have of trypanosomiasis in the Philippines was by Smith and Kinyoun, in 1901. The history of the epidemic in this country has been reported by Musgrave and Williamson in a preliminary report on trypanosomiasis of horses in the Philippine Islands, published as Bulletin No. 3, bureau of government laboratories. This report was read before the Manila medical society, and brought out considerable discussion. The only point at issue was our statement that the disease was introduced here in 1901. We have investigated, as far as possible, the arguments brought forth that surra was here prior to that time, but have found nothing to justify any change in our original statement. The subject is not of great importance one way or the other, except for its historic interest. There is one thing absolutely certain—that the disease was introduced at that time, and, whether this was its original appearance or not, the frightful epidemic which has raged here is positively connected with this infection. Our statements regarding the manner of its spread were absolutely convincing at the time of the publication of the preliminary report, and additional work along these lines has since confirmed the conclusions there given.

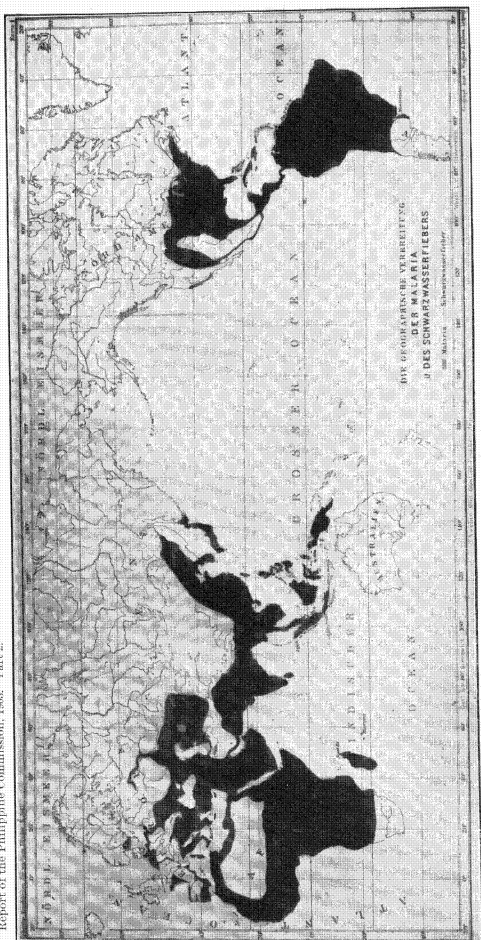
During the past month we have had proof of the reimportation of the disease, this time in a cow received from Java.

Since its introduction the infection has been spreading throughout the archipelago, and at the present time areas in which it is prevalent are reported from almost the entire group of islands.

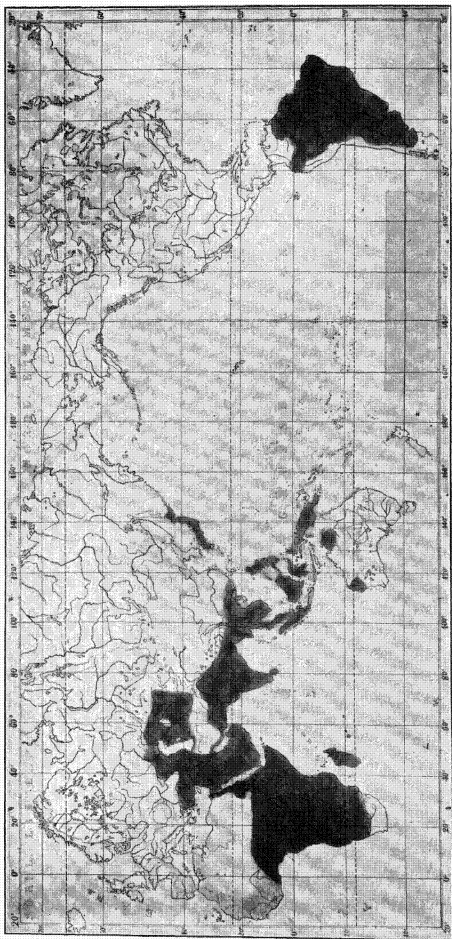
ETIOLOGY.

Geographic distribution.—The geographic range of the various forms of trypanosomiasis is shown in the following table:

Continent.	Country.	Province, territory, division, district, etc.	Form.	Reported by—
Asia	India	Bengal	Surra	Lingard.
		Berars	do	Do.
		Bombay Presidency	do	Do.
		Burma	do	Lingard, Steel.
		Cashar	do	Lingard.
		Kohat	do	Lingard, Gunn.
		Konkan	do	Lingard.
		Kumaon Province	do	Do.
		Naga Hills	do	Do.
		Manipur	do	Do.
		Northwest Provinces	do	Do.
		Punjab	do	Lingard, Evans.
		Rajputana	do	Lingard.
		Cochin China (Tonkin)	do	Blanchard, Mollereau.
		Indo-China (Nha Trang)	do	Carougeau.
		Korea	do	W. G. Campbell.
		Persia	do	Haig.
		Syria	Dourine	Nocard and Leclainche.
	Java	Bantan	Surra	Paszotta.
		Cheribon	do	Do.
		Deli	do	Vrijburg.
		Rembang	do	Penning.
		Semarang	do	Do.
		Soemedang	do	Hubenet, De Does.
		Tegal	do	Paszotta.
		Philippines	do	Smith and Kinyoun, Slee, Curry, Salmon and Stiles, Strong, Musgrave and Williamson.
Africa	Algeria		Dourine	Chauvrat, Merche, Signol, Viordot, Lacquerrain, and William.
		Abyssinia	Surra	Bruce, Hallen.
		English East Africa	Nagana	Story.
		Egypt	Surra	Lingard.
		German East Africa	Nagana	Koch.
		Kongo	do	Scloss.
		Madagascar	Surra	Lingard.
		Mauritius	Nagana	Edington.
		Morocco	Dourine	Bruce, Nocard, and Leclainche.
		Nubia	Nagana	Hallen.
		Somaliland	do	Brumpt.
		Soudan	do	Schilling, Dupuy, and Pierre.
	Togo		Surra	Koch, Schilling.
			Nagana	E. Martini.
		Tripoli	Dourine	Nocard and Leclainche.
		Transvaal	Nagana	Theiler.
		Zambesi	do	Livingstone.
		Zululand	do	Bruce.
Europe	Malarial Zone (see map).		do	Do.
		Bohemia	Dourine	Weber and Nocard.
		France	do	Legrain.
		Germany	do	Haverman, Hausmann, and Pfannenschmidt, Voges.
		Celle	do	Hertwig.
		Trakehnen	do	Nocard and Leclainche.
		Hungary	do	Weber and Nocard.
		Pyrenees	do	Nocard and Leclainche.
		Navarra	do	Do.
		Turkey	Dourine	Do.
South America	Argentina	Catamarca	Mal de caderas	Sivori and Lecler.
		Chaco	do	Do.
		Corrientes	do	Do.
		Formosa	do	Voges.
		Misiones	do	Sivori and Lecler.
		Santa Fe	do	Voges.
		Matto Grosso	do	Do.
		Bolivia	do	Do.
		Brazil	do	Rebourgeon.
			do	Sivori and Lecler.



THE GEOGRAPHIC DISTRIBUTION OF MALARIA AND OF BLACK-WATER FEVER (COPIED FROM SCHEUBE).



SHOWING GEOGRAPHIC DISTRIBUTION OF TRYPANOSOMIASIS.

Continent.	Country.	Province, territory, division, district, etc.	Form.	Reported by—
South America	Chile	.....	Mal de caderas	Voges.
	Marajo Island	.....	do	Lacerda.
	Paraguay	.....	do	Thompson.
	Uruguay	.....	do	Sivori and Lecler.
North America		.....	Surra	Do.
		United States.....	Dourine	Lingard.
Australia			Surra	Nocard and Leclainche, reports of the Bureau of Animal Industry.
				Lingard.

Figure 55 gives a schematic representation of the infected areas, drawn from Scheube's map (fig. 3) illustrating the regions of the world in which malaria prevails. Figure 56 is intended to show the relation in geographic distribution of trypanosomiasis and malaria.

The table and maps given above illustrate the wide geographic distribution of trypanosomiasis and its special prevalence in the tropical and subtropical zones. New points of infection are being reported from time to time. Neither the table nor the maps are complete, and both may contain some inaccuracies, owing to the conflicting reports and the fact that some of the references given are not available.

Climatic conditions.—All the different forms of this disease are infections incident to the periods of wet weather. This statement is made in all discussions of the subject which we have been able to review. The reasons given for the fact are varied, but the true explanation, namely, that biting flies are much more numerous during this season than during any other, is confirmed by nearly all recent writers. Not only this, but the rainy season offers another and equally important condition, which will be fully discussed under modes of transmission, i. e., the dark, cloudy days with great relative humidity make it possible for the fly mechanically to carry the infection for a much longer time. We have shown conclusively that bright sunlight quickly destroys *Trypanosoma*; and even if the proper flies were more numerous during dry weather this factor alone would greatly limit their ability to carry infection.

To sum up, the transmission of the disease is greatest exactly under the climatic conditions most favorable to insect life and to the insect's ability to carry the living infection. Such conditions occur in low-lying, marshy lands during the dark, cloudy days of the rainy season.

Trypanosomiasis prevails to a limited extent under other circumstances, but we have reason to fear epidemics only when those above described are realized.

We know of no other predisposing causes for surra. All species of animals within certain geographic zones may contract the disease by experimental methods. As will be shown, natural infection is a mechanical process, so that no reason exists against the supposition that all animals are susceptible to the usual methods of transmission.

A number of writers have stated that a greater percentage of foreign horses coming into an infected zone than of native animals contract the disease.

Of 80 horses observed by Lingard, 16 per cent died during the first year, and 70 per cent during the first seven years while under observation. Australian horses were found by him to be more susceptible than the native horses of India.

In our experience in Manila, Australian, Chinese, and American horses do not appear more susceptible than native ponies. In several instances we have been able to observe the infection in large stables containing both native and American horses, and under these conditions one appeared to contract it as readily as the other. The greatest percentage affected in either case is always found in large groups of animals; and as American horses are more frequently collected in large stables, a superficial deduction from this fact might be misleading. In reality, the higher percentages we have encountered have occurred in stables containing native ponies.

Lingard considers both sexes to be equally susceptible. We have had no opportunity either to confirm or to disprove this statement, as nearly all the horses in Manila are males. Sex certainly plays no part in the communication of the disease in other animals, and there is no reason to suppose it would do so in horses.

In 1885 Steel stated that white and gray mules are more susceptible to surra than darker colored animals, and, among others, Laveran and Mesnil believe this to be the case with horses as well. They attribute this phenomenon to the supposed fact that flies bite light-colored animals more readily than dark ones. This fact is questioned by some authors, although it is true that on the former animals the flies may be more noticeable than on the latter. We have been unable to verify this statement. White and gray animals have not been infected in greater proportion than others,

nor do they more readily attract biting flies. As a matter of fact, our statistics of the Philippine epidemic show them to be less frequently attacked. No importance can therefore be attributed to color as a factor in the spread of the disease.

In general, no material difference in the percentage of infection in horses of varying ages has been found. The greater proportion of animals in Manila are older than four years. Our investigation of rats has shown us that the older animals contain *Trypanosoma* more often than the younger ones. The difference is probably not due to the greater susceptibility of the former, but is accounted for by the fact that, like dogs, they are prone to fight, and hence very frequently have wounds, particularly about the head, which naturally favor the entrance of the parasites.

TRYPANOSOMA.

Historic note.—In this discussion the species of *Trypanosoma* have been followed in part at the expense of the chronologic order of publications.

Valentin (1841) discovered a *Hematozoon* and Glugge (1842) parasites, the former in trout (*Salmo fario*) and the latter in the blood of frogs. Both were probably *Trypanosoma*, Doflein considering Glugge's description sufficient for the recognition of the genus. In 1843 Gruby observed a flagellate infusorium in frogs, naming it *Tr. sanguinis*; and despite the previous work of others, he has generally been credited with its discovery, his work being subsequently confirmed by a number of investigators.

Lankester (1871) discovered a sausage-shaped parasite in the blood of frogs, naming it undulina. Gaule (1880) made some further observations on these bodies, which he considered protoplasmic portions of the blood corpuscles separated for a short period of independent life and more prevalent in very dry, warm weather. Leucocytes were seen to be converted into flagellates and then back to leucocytes. Bütschli and Lankester, commenting on Gaule's work, stated independently that the conversion of ameboid bodies into flagellates and the reconversion of flagellates into bodies resembling white corpuscles did not prove the latter to be leucocytes.

Grassi (1882) observed in frogs a parasite which was named paramecioides.

Blanchard (1889) confirmed Gruby's work and gave the following synonyms: *Paramecium loricatum* Mayer, 1843; *Ameba rotatoria* Mayer, 1843; *Globularia radiata* Wedl, 1849; *Paramecium costatum* Chaussat, 1850; *Undulina* Ray Lankester, 1871; *Paramecioides costatus* Grassi, 1882; and *Hematomonas* Mitrophanow, 1883.

Danilewsky (1885) described at least six varieties of parasites in the blood of frogs. He noted the change in the blood at rest from the flagellate to the ameboid stage, as had already been mentioned by others. Ameboid forms were seen to segment into sixty-four spores, which gradually assumed monad forms and divided by longitudinal division. Transverse division also was occasionally seen. Flüge (1896) stated that these parasites very closely resembled *Tr. lewisii*. Multiplication consisted in longitudinal and transverse division and spore formation, the latter sometimes being preceded by an ameboid stage. He gave the length as 80 microns and mentioned that the parasites were provided with an undulating membrane and flagella. He said that they were found in frogs, tortoises, fish, birds, oysters, chickens, and geese. In general structure they resembled *Trypanosoma*. Their pathogenic action was not known.

Koninski (1901) again called attention to the probability of an increase in the occurrence of *Tr. sanguinis* Gruby with the age of the animals. They were found at all seasons of the year and are more common in males than in females. No disease was produced in frogs, and there was no evidence of the mode of transmission in these animals even when they were kept together for months.

Eberth (1861) discovered in the intestines of birds a parasite which was named by Kent *Tr. eberthii*, but which, in all probability, was a *Trichomonas*.

Lewis (1878 and 1879) described *Trypanosoma* found in the rats of India. In a second paper, published in 1884, he considered these *Trypanosoma* identical with *Tr. evansi*. Opie, Flüge, and some other writers give the credit for discovering *Tr. lewisii* to Osler, but we have been unable to verify the reference, and Osler does not indicate that such is the case in his article on the *Hematozoon* of malaria (B. M. J., March 12, 1887) in which he reviews the work of Lewis and others on *Trypanosoma*.

Bütschli (1880) found flagellates in the intestinal canal of a nematode (*Tribolus gracilis*) and also in the intestines of domestic flies. Including flagella they measured about 33 microns in length and were sometimes observed in stellate colonies.

Wittich (1881) discovered in the blood of hamsters a *Trypanosoma* which he considered identical with *Tr. lewisii*. This observation was confirmed by Koch. Wittich's work was done in Germany on twelve hamsters imported from Africa. He states that his organism agrees in all respects with Lewis's description of the *Trypanosoma* of rats in India. Eleven of his hamsters died; but he did not consider

Trypanosoma to have played any part in the malady to which they succumbed, although present in all.

G. Evans (1880) discovered *Trypanosoma* in the blood of horses suffering with the well-known surra of India. He proved the causative agency of these parasites in the production of the disease. Steel (1885) confirmed Evans's work, and named the parasite *Spirocheta Evansi*. Crookshank (1886) made a report on these parasites, confirming Evans's and Steel's work. He considered these *Trypanosoma* identical with Mitrophanow's *Trypanosoma* of carp.

Kent (1881) discovered "*Herpetomonas*" in the intestines of the domestic fly. His parasite had no undulating membrane and was probably not a *Trypanosoma*.

Cortes (1882) found in the digestive tube of an oyster a parasite which has been named *Tr. balbianii*. The general description follows that of *Trypanosoma*, but slight differences of internal structure were noted. Undulating membrane and flagella were present, but nucleus, nucleolus, and vacuole were not observed. In a later paper he demonstrated a nucleus. He considered this *Trypanosoma* closely related to Mitrophanow's "*Hematomonas*" (*Trypanosoma*) of fish. Laveran and Mesnil (1901) found these parasites rarely in Portuguese oysters and frequently in common oysters. They say that the bodies were not flagellate and that the presence of an undulating membrane was questionable. They do not consider Certes's organism a *Trypanosoma*, but rather a bacterium.

Mitrophanow (1883) described *Trypanosoma* in mudfish (*Cobatus fossilis*). His parasite was 1 to 1½ microns broad and 30 to 40 microns long. He gave a very careful description of this organism, which occurred in nearly all the fish examined and was more numerous in hot than in cold weather. He gave the group the name "*Hematomonas*" and described two species.

Moebius (1883) found *Trypanosoma* in oysters (*Tapes decussata* and *Tapes pullastra*). These parasites were studied by Lustrac (1896), who considered them *Trypanosoma*.

Marchifava and Celli (1885) found in the blood of a patient with malarial fever parasites very closely resembling the *Trypanosoma* of frogs, birds, and fish. Nepveu (1898) described *Trypanosoma* in seven cases occurring in men, six of whom were suffering from malarial fever. Barron is quoted by Laveran as having seen flagellates in the blood of an anæmic woman. During 1902, Dutton, Forde, Sambom, Manson, and others have described the occurrence of *Trypanosoma* in human beings. Dutton first published an account of these parasites, found in the blood of Doctor Forde's patient.

Danilewsky (1890) found a *Trypanosoma* in the blood of birds, naming it *Tr. sanguinis evansii*. Like Bütschli's parasite, it had a long flagellum and an undulating membrane. Division was longitudinal, transverse, or by segmentation from the ameboid stage. No symptoms were produced in the host. Danilewsky thought this probably due to the high temperature of the birds or the tolerance acquired by generations of infection.

Laveran and Mesnil (1901) found *Trypanosoma* in three kinds of fish—brochet, sole, and redeye. That found in the brochet they say closely resembled *Tr. evansii*, etc., and was named by them *Tr. remakii*, after Remak, who, they say, first observed the parasite in 1842. The *Trypanosoma* from the sole was also of the same general type, and they designated it as *Tr. soleæ*. Laveran and Mesnil state that *Trypanosoma* had not previously been observed in salt-water fish, but in this they are probably mistaken, for Flüge (1896) reported finding them in the fish of the Mediterranean Sea. The organism which they found in the redeye had a flagellum at each end. They placed it in a separate genus, which they called *Trypanoplasma*, giving the parasite the name *Trypanoplasma borrelii*.

Rouget (1896) described *Trypanosoma* found in the blood of a horse suffering from dourine (beschâlseuche), and for two and one-half years continued the study of this organism in susceptible animals. Wasilewsky and Senn (1899) confirmed Rouget's work, and determined the pathogenic action of this *Trypanosoma* for the horse, passing it through other animals and back to the horse, reproducing the disease. Voges says that this *Trypanosoma* was discovered by Chauvrat in 1892.^a Laveran and Mesnil (1901) proposed the name *Tr. rougetii* for the parasites of dourine. Doflein (July, 1901) named it *Tr. equiperdum*, which is the name used also by Salmon and Stiles.

Elmassian, according to Voges, in 1901 first differentiated the *Trypanosoma* of mal de caderas in South America, while Voges (1902) very carefully described the parasite, proved its pathogenic action, and named it *Tr. equinum*.

Theiler, in an article published by Bruce (1902), is credited with the discovery of a new *Trypanosoma* of cattle in South Africa. Bruce proposed the name *Tr. theileri*.

^a Reference not available.

During the same year Theiler found a different species of *Trypanosoma* in the cattle of the Transvaal, sending specimens of it to Laveran, who bases his statement that it is a distinct genus, particularly on the location of the centrosome near the center of the body, close to and sometimes united to the nucleus. He proposed the name *Tr. transvaaliense* for this parasite.

In 1901 Smith and Kinyoun described a parasite which had been observed by Doctor Jobling in the blood of a sick horse in Manila, and this parasite was afterwards determined to be a *Trypanosoma*. Later in the same year Smith made some additional notes on the organism and considered it *Tr. evansi*.

Curry (1902) described the parasite and classed it as a *Trypanosoma*, but was unable to state whether it was *Tr. evansi* or *Tr. brucei*. His description was the first accurate one of the parasite found here.

Technique for the study of Trypanosoma.—For the determination of the presence of *Trypanosoma* in the blood only a fresh preparation, such as is used for the examination for malaria, is needed. The parasites, where numerous, are readily observed with a DD, or even an AA, objective and No. 4 ocular Zeiss. If they are scarce, considerable time may be necessary to find one, but once seen the diagnosis is easy, and may be facilitated by staining the specimen by any of the approved methods. For a careful study stained specimens are essential.

Fairly good results are obtained by any of the methods used for staining malarial parasites. Romanowsky's method, or any of its modifications, particularly Wright's, gives beautiful pictures. Laveran and Mesnil have also published directions for making an excellent stain.

A most satisfactory stain for *Trypanosoma* is one prepared by Dr. Paul G. Woolley, pathologist in this laboratory, and published here for the first time with his permission.

Fix smears in absolute alcohol for ten minutes.

A.—Eosin (w) (Grubler).....	grams..	1
Distilled water.....	do....	1,000
B.—Polychrome methylene blue (Unna).		
C.—Methylene blue (Med.) (Grubler).....	do....	1
Distilled water.....	do....	100
D.—Of solution B.....	parts..	2
Of solution C.....	do....	1

Mix and add 1 c. c. of A to each 4.5 c. c. of D.

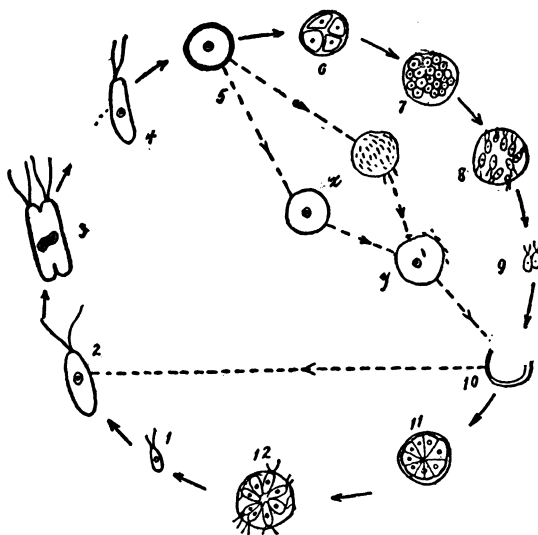
Stain by immersion for twenty to thirty minutes. Wash with water. Wash for two to five seconds with solution A and blot immediately.

The effects on protoplasm and nuclear material may be regulated by longer and shorter exposure to the eosin solution in the last step.

Life cycle.—Salmon and Stiles write of flagellates as follows:

"In general, but especially in reference to the lower forms, it may be said that the protoplasm is quite homogeneous. A nearly fluid endoplasm may be recognized surrounded by a peripheral ectoplasm. The latter in turn may be bounded by a more dense layer, like a delicate cell membrane. These three divisions are, however, not always very distinct, but grade almost imperceptibly into one another. The pharynx is a very superficial infundibulum. A permanent anus appears to be absent, but the excreta appear to be expelled from a less resistant point at the posterior extremity, without, however, leaving any trace of their passage. The flagellum represents an organ of locomotion, and there may be one or more present. The pulsating vacuole is near the surface, but does not appear to possess either a distinct membrane or a permanent pore. The nucleus is rounded and appears to be provided with a nuclear membrane and nucleolus. If conditions become unfavorable, as when the medium becomes too condensed by evaporation or too toxic by extreme putrefaction, the flagellate may discard its flagellum, become round, and form a surrounding cyst membrane. Upon return of favorable conditions it may escape from the cyst, and, forming a new flagellum, recommence its active life, or it may divide during encystment. The division of the free form in multiplying is usually longitudinal. In some cases the organism encysts before dividing. Then, by a longitudinal division, two organisms are formed. The latter may then escape, form their flagella, and become active, or each daughter organism may reencyst and divide further, or the mother flagellate, when encysted, may divide into a large number of so-called 'spores,' each of which, upon escaping, forms its flagellum. There may also be a complete conjugation of the two individuals, followed by encystment and division into numerous young."

The illustration (fig. 57), taken from Doflein, is intended to show the variations in the life cycle of the flagellates.



But little is known with reference to that of *Trypanosoma*, and the majority of writers so express themselves. However, a number have observed in the blood bodies of various kinds, which they have considered as having to do with the phase in the cycle of development. Voges and others consider the entire life cycle of the parasite to be acted out in the blood and present very good arguments in favor of their conclusions. Schat is the only author, among those whom we have been able to review, who believes in an intermediate host for the parasites.

He says: "Analogously to what is known to be true in malaria, it appears that the surra parasite also goes through a cycle of sexual development in the body of the fly, and in that of the horse, cow, and donkey an asexual one. The asexual development may be of two kinds, one the formation of spores and the other division.

"In the blood of horses or cows and in that of our experimental animals we have not observed during the whole course of the investigation a sexual union of the parasites, which is contrary to the observations of Penning and Plimmer and Bradford, who make mention of forms of conjugation.

"In this regard we feel justified in supposing that an hypothesis similar to that which Manson proposed for malaria holds true also in the case of surra; that is, a blood-sucking insect (the *Stomoxys*) serves as a host in this disease also, and that the surra parasite is propagated in the body of this insect outside of the horse and cow." Fig. 58 taken from this author illustrates his observations.

We are inclined to accept Voges's idea of the life cycle. *Trypanosoma* have not been found living outside the animal for any considerable length of time; the removal of the animal host from a locality always results in the disappearance of the disease, and attempts permanently to infect media of any kind have usually proved unsuccessful. We have performed a number of experiments with biting flies caught on sick animals, and have failed to convey the disease after twenty-four hours, either by allowing these flies to bite susceptible animals, or by injecting or feeding emulsions of these insects during their lifetime. This, of course, argues against the probability of any but a short life cycle in these insects.

Recently Novy has reported the cultivation of *Tr. lewisii* for over a year, without any loss in their virulence, in a medium composed of agar and rabbit's blood. Only very brief mention of this report has been received, and we are unable to determine what is meant by "no loss of virulence" in *Tr. lewisii*. The work is interesting and the results would seem to furnish further evidence that an intermediate host plays no part in the life cycle of *Trypanosoma*.

General character.—Trypanosoma of all species are in general similar organisms. The family diagnosis, as given by Salmon and Stiles, is as follows:

*Flagellate parasitic forms with one chief flagellum directed anteriorly; in some forms a secondary flagellum directed posteriorly; body usually with two angles, and

wound more or less in the form of a spiral; one angle of the body provided with an undulating membrane. One nucleus and one centrosome present."

The morphology varies greatly in the same species of *Trypanosoma*, and also to a greater extent in different species. In general the parasites may be said to measure from 1 to 5 microns in thickness and from 15 to 45 microns in length, including flagellum. They all show very active eel-like movements and some motility. In some species the latter is very slight, the parasites undulating with extreme rapidity but covering so short a distance as to be easily followed under the microscope; while in others, especially *Tr. lewisii*, the movements are often so rapid in freshly drawn blood that it is impossible to keep the parasite in the field. Some writers have used these variations in motility as a diagnostic point in differentiating the organisms, and in general some importance may be attached to it; but there are so many exceptions, due to conditions which are not understood, that its value in differential diagnosis may partly be disregarded. Variations are occasionally found in one species, often indeed in a single preparation, which are nearly as great as those observed between different species.

The flagellum at the anterior end of the parasite, in all forms which we have studied, varies greatly in length. It is always actively motile, pointed, and continuous, with the thickened margin of the undulating membrane ending at or near the centrosome or micronucleus. It may be entirely homogeneous, or it may contain from two to several distinct granules extending well out from the body of the parasite.

The undulating membrane extends along one border of the organism from near the centrosome in the posterior portion to the anterior end of the parasite, from where it continues as the free flagellum. Its breadth and folds vary considerably in the same and in different species of parasites, and also, no doubt, to a considerable extent with the age of the *Trypanosoma*. Many authors assert that the young forms are entirely free from this membrane.

The nucleus is usually situated in the anterior half of the parasite and varies considerably in size and shape. It is generally oval or round, and assumes other contours with the different stages of division.

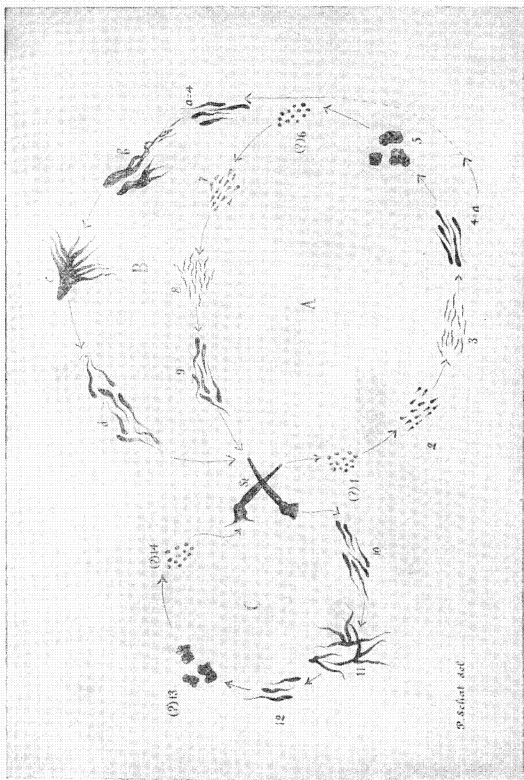
The centrosome is usually in the posterior and more blunt end, and appears to have an intimate association with the flagellum and undulating membrane. Its varying distance from the posterior end has been used as a diagnostic point in determining the species, but not much importance can be attached to it, for it has been shown that the posterior end of the *Trypanosoma* is undoubtedly contractile, so that the distance from the extremity at which the centrosome is found, and also, to a certain extent, the degree of bluntness of this part—a feature which has been so much discussed depend partly upon its contraction or elongation at the time of fixation for staining and study.

The protoplasm is homogeneous or granular, depending upon the age of the parasite, its environment, and no doubt to a certain extent upon the species. The granules may vary in number and size from a very few small ones situated in the anterior portion of the *Trypanosoma* to numerous large ones scattered throughout the protoplasm.

Multiplication.—Voges gives three forms of multiplication, i. e., longitudinal and transverse fission and segmentation. He did not observe conjugation. The chromatin divides into from 3 to 10 segments, which assume irregular shapes and locations, and some of which are often found well up in the flagellum. The nucleus usually divides into equal parts, but may break into several segments. After division the protoplasm may assume various irregular forms. The young nuclei arrange themselves in groups, and the parasite twists and splits by longitudinal or more often by transverse fission. The new division forms are often bowl-shaped, but gradually assume their regular outline. Sometimes a parasite assumes the appearance of a globular mass, nuclei, showing a number of flagella, form around the periphery and division into several segments occurs.

Plimmer and Bradford consider longitudinal and transverse division the more frequent modes of reproduction, although they observed also conjugation, which consisted in the fusion of the micronuclei, followed by an ameboid stage and division by segmentation. The ameboid stage at times occurred independently of conjugation.

Martini, who has recently worked with *trypanosoma* obtained from an infected pony imported to Berlin from Togo, gives five stages of multiplication as follows: First stage: Broadening out of the chromatin grains of the nucleus; flagellum thickens; nucleolus appears to be a thick streak; chromatin granules loosen. Second stage: Two chromatin heaps; two nuclei; pairs remain together; beginning division of the undulating membrane. Third stage: Two distinct membranes seen. Fourth stage: Two flagella, one slightly shorter than the other. Fifth stage: Young *trypanosoma* attached only at the posterior end. Sometimes one of these is already seen in the process of fission.



Illustrating the life cycle of *Trypanosoma*. (After Schat, 1901.)

Explanation of figure 58.

Circle A gives a schematic representation of the cycle of asexual development of the surra parasite through the formation of spores in horses, cattle, etc.
 Circle B the changes in the sexual development of the surra parasite through partition, in horses, cattle, etc.
 Circle C the cycle of sexual development of the surra parasite in the body of the *Stomoxys* fly.
 Circle A.—1, spores introduced into the body of a horse, cow, etc., through the bite of a fly; 2, the minute conical bodies which result; 3, the young surra parasites which spring from these minute bodies; 4, the matured surra parasite; 5, the ameboid form which results; 6 (?), the formation of spores; 7, the minute conical bodies; 8, the young surra parasite; 9, the matured surra parasite.
 Circle B.—a, b, c, d represent forms of partition; St, the sucking and biting instrument of the *Stomoxys*.
 Circle C.—10, the surra parasite in the stomach of the *Stomoxys*; 11, process of conjugation in the stomach of the *Stomoxys*; 12, the surra parasite produced; 13, 14, not yet observed, but are probably the subsequent stages of development in the body of the fly.

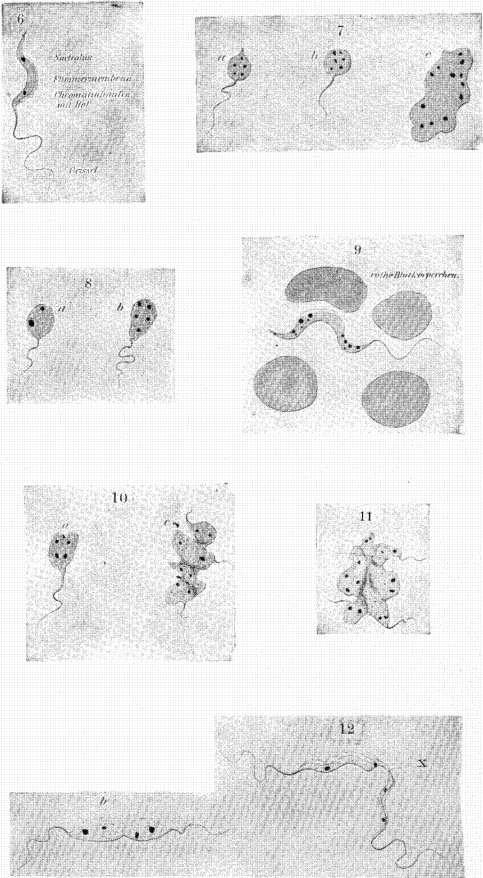


FIG. 59.

Nos. 6-12.—6, Young adult *Tr. equinum*; 7, degeneration forms; 8, young *Trypanosoma*; 9, multinuclear adult *Trypanosoma*; 10a, longitudinal division; 10b, transverse division; 10c, multiple division; 11, irregular form; 12, two young *Trypanosoma* not yet separated. (After Voges, 1901.)

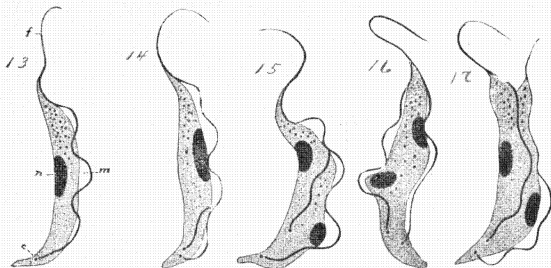


FIG. 60.

Nos. 13-17.—13, *Tr. brucei* (n, nucleus; c, centrosome; m, undulating membrane; f, flagellum); 14, beginning division, showing two centrosomes and partial division of flagellum; 15, 16, 17, further stages of division. (After Laveran and Mesnil, 1901, figs. 1 to 5.)

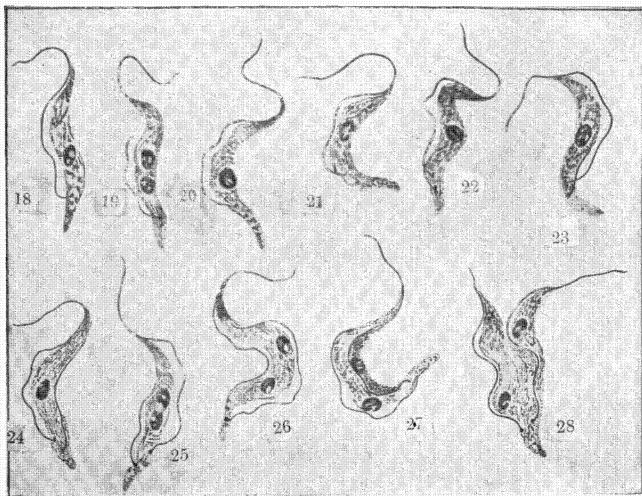
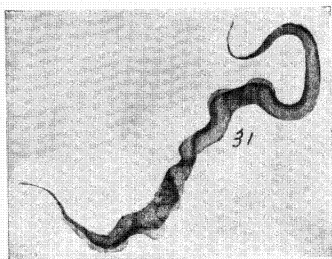
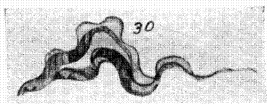
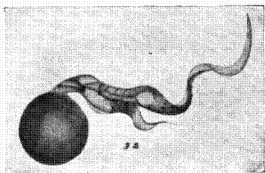
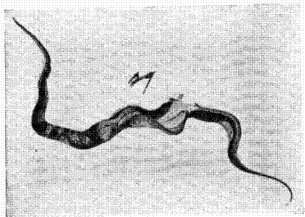


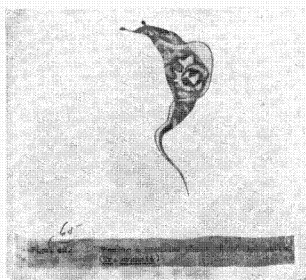
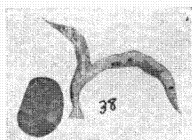
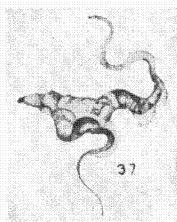
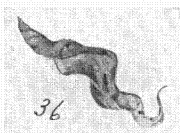
FIG. 61.

Nos. 18-28.—*Tr. equinum*, showing various stages of division. (After Sivori and Lecler, 1902, Pl. III.)

18, *Trypanosoma* with two chromatin corpuscles of the flagellum; 19, *Trypanosoma* with two nuclei; 20, *Trypanosoma* with a nucleus, two chromatin corpuscles, and a short flagellum, which starts from the posterior chromatin corpuscle and is united or not to the other flagellum; 21-24, *Trypanosoma* with a large nucleus, slightly elongated, two chromatin corpuscles; two flagella, one shorter than the other and united to it or not; 25-27, large *Trypanosoma* with two separate nuclei. The protoplasm is accumulated toward the poles of the nuclei and is rarer in the middle. Two flagella, one longer than the other, or equal and separate; 28, *Trypanosoma* similar to the preceding, but the flagella at the or anterior extremities have begun to separate.



FIGS. 62, 63.
Nos. 29-35.



FIGS. 64, 65.

Nos. 36-42.

He did not observe any other forms of multiplication or conjugation.

Schilling did not see multiplication forms in the circulating blood in connection with surra in Togo. He considers the mode of division to be influenced by the number of chromatin granules found in the parasite and to be usually by longitudinal fission. He did not observe ameboid forms or conjugation. He gives two stages in the usual mode of multiplication. In the first one a double undulating membrane is seen, and in the second the whole undulating membrane divides longitudinally and gradually separates the parasite, the posterior end being the last to part. Young forms have no undulating membranes. Daughter parasites are always smaller than the parents.

Laveran and Mesnil have studied the forms of multiplication very carefully and consider that with the *Trypanosoma* of nagana, multiplication in the blood is by longitudinal division only and into young of equal size, which are also nearly as large as the adults.

Dividing forms are always present in the blood, and just before division begins the parasite increases in size. The order of division is as follows: (1) Centrosome, (2) flagellum, and (3) nucleus and protoplasm. The centrosome first elongates and divides into two round bodies followed by a division of the flagellum. The nucleus increases in size. New nuclei are then formed by direct division. The protoplasm follows the nucleus in separation and may begin at the free end. Two parasites may remain attached at the posterior ends for some time after division, and both may then divide again before separation is complete. These authors have not yet seen the young forms of Kanthack, Durham, and Blandford, or the ameboid forms of Plimmer and Bradford. They give some variations from the parasite as described by Lewis, but this point will be more fully discussed under "Differential Diagnosis of *Trypanosoma*."

Sivori and Lecler agree with Laveran and Mesnil as to the modes of multiplication illustrated by fig. 61, 18-28.

Rosette formations of *Trypanosoma* have been extensively noticed, but considerable difference of opinion as to their cause has been expressed. Some consider them as entirely a multiplication phase, others as agglutination, while the majority agree that such formations may be the result of either of these phenomena. There certainly can be no question that these figures occasionally result as a phase of multiplication. Rabinowitsch and Kempner compare them to the segmenting malarial parasite.

The methods of reproduction described comprise those of the most importance and represent the views of many of the writers whom we have been able to review. Schat, as has been seen in the discussion of the life cycle of *Trypanosoma*, holds some very original opinions. So far as his work has to do with multiplication, he maintains that the asexual, longitudinal division occurs in the blood of infected animals and that the sexual reproduction takes place in certain flies.

In our studies we have never observed conjugation, and in blood under normal conditions reproduction by transverse division or segmentation is very rare. Longitudinal division is by far the most frequent form, and usually takes place in the order given by Laveran and Mesnil. This is not constant, however, for in the same specimen of the parasites taken from the blood of an infected dog, horse, or other animal, we have seen individuals showing this order and others in which the division certainly differed from the course described by these authors. Figs. 32-35 illustrate this point. Elmassian, working with the South American disease, has recently reported results similar to ours.

The parasites, just before death is evident, usually become thicker, but sometimes this stage is not perceptible. When it occurs, it may proceed to such an extent that the transverse diameter of the *Trypanosoma* will measure from 5 to 7 microns before any other evidence of division can be observed (No. 35). From this point the picture is not constant. In many forms the next change to be noticed is a division of the nucleus into one or more parts (fig. 63, no. 34, 35). The centrosome usually divides first, although in some instances the flagella show beautiful division extending well down into the undulating membrane, without the slightest apparent change in either the centrosome or the nucleus.

Schilling's statement that the mode of multiplication depends upon the number of granules which the parasite contains appears to us deserving of careful consideration. Longitudinal division in an individual containing numerous large granules is rarely seen. These parasites assume numerous shapes and often arrange themselves as if segmentation were in progress (fig. 64, 36-42), and in the majority of cases they are the ones that produce the involution forms.

Agglutination.—Several observers have noted the bunching together of *Trypanosoma* under certain conditions, and have described the phenomenon as agglutination. Some, as has already been mentioned, consider this to be a multiplication phase, while others suppose it to be the natural position assumed by the parasite just before dying. The process has not been seen at all by some of the most careful investigators.

Laveran and Mesnil regard the agglutination of *Trypanosoma* as a phenomenon similar to that produced in bacteria and believe it to be brought about by a number of conditions. Among their reasons for this conclusion they mention the continued motility of the parasites after clumping and the fact that the reaction is most marked with weak specific sera and less so with strongly fortified ones. Rabinowitch and Kempner, however, were unable to obtain agglutination with their specific serum. According to Laveran and Mesnil, the reaction may be obtained both with living organisms and with dead ones, and it does not stop the motility of either the individual or the aggregation of parasites.

The reaction always begins in the same way. Two parasites are seen to join by their posterior ends (fig. 67, 45) and from a number of these rosettes are built up the posterior ends of the individuals pointing toward the center and their bodies extending outward like the spokes of a wheel. (Fig. 66, 43 and 46.) Such masses may, under certain conditions, group themselves and form secondary axes. (Fig. 67, 44 and 47.)

Agglutination often occurs in defibrinated blood containing *Trypanosoma* and kept on ice. The serum obtained from a rat partly immunized by the injection of blood containing *Trypanosoma*, when mixed with infected defibrinated blood, causes agglutination.

Parasites which have been killed or paralyzed by formol, chloroform, or a specific serum are agglutinated by the same agencies which produce the reaction in the living organism.

Agglutinations often are not permanent, and under certain conditions, according to Laveran and Mesnil, "disagglomeration" takes place. In this the secondary formations are first broken up, and then the primary rosettes disunite or lose a part of their elements. They consider this "disagglomeration" to be in inverse ratio to the agglutinating value of the serum employed.

Normal rat's blood has no agglutinative action, but when fortified by inoculations does gain this power. Five to 10 c. c. of trypanosomatic blood injected into a rat will produce a serum capable of agglutinating *Trypanosoma* in defibrinated blood in a dilution of 1-5 to 1-50.

One of Laveran and Mesnil's rats, which in seven months had received 13 inoculations of blood containing *Trypanosoma*, gave a serum which in a dilution of 1-10 so paralyzed the *Trypanosoma* that rosettes were not formed.

Serum exposed to a temperature of 55° to 58° C. during one-half to three-fourths of an hour did not lose its power to agglutinate, but was materially weakened. Exposure to 63° to 65° C. for half an hour completely destroyed its agglutinative properties.

Adult guinea pigs were immunized by several injections of infected blood. Their serum had a feeble agglutinative reaction for *Tr. brucei*. With a similar serum from young guinea pigs no agglutinative reaction was obtained. The serum of a pigeon, guinea pig, or frog did not show an agglutinative reaction for *Tr. lewisii*, but that of a sheep, dog, or rabbit gave a slight one for these parasites. With sera from the horse and the chicken agglutinations were more definite and occurred in dilutions of 1-2 to 1-10.

Of all the animals examined, the serum from the horse was the most active and that of the chicken second, but in both of these the reaction was greater for red blood cells than for *Trypanosoma*. Human serum did not agglutinate *Tr. brucei*, but the sera of guinea pigs and of pigs, which have no curative properties, gave beautiful agglutinations when mixed with trypanosomatic blood. This would seem to prove that agglutinating and curative properties are separate and distinct. Agglutinations once formed had a tendency to disagglutinate in most sera as well as in other substances. In the rabbit this was accomplished at the end of several hours. They persisted best in the sera of the dog and the sheep. Rats immunized by repeated injections of *Tr. lewisii* showed but feeble agglutinative reaction with their own parasites.

According to Rost, surra blood mixed with goat serum in the hanging drop in a moist chamber, killed the *Trypanosoma* in two and one-half minutes, sometimes with agglutination; control parasites were all dead in twenty-three hours.

Sivori and Lecler, in a preparation of horse's blood containing numerous *Trypanosoma*, sometimes observed two, three, and even six individuals or more, united at their posterior extremities and arranged in a radiate figure. The center of the figure was sometimes near a red corpuscle or a leucocyte. The parasites so united preserved their motility. In the blood of a young cat, containing numerous *Trypanosoma* and prepared in a hanging drop, there were visible at the end of an hour eight, ten, or twelve agglomerated parasites. Many of these agglomerations separated after a certain length of time.

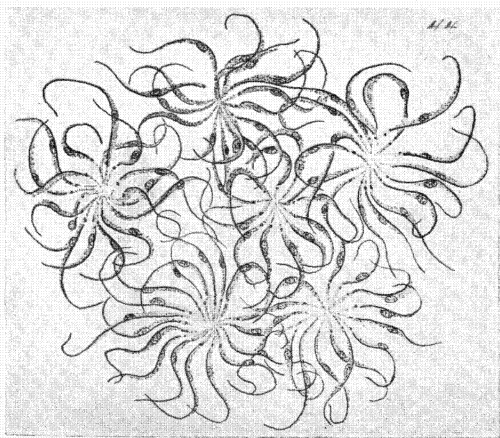
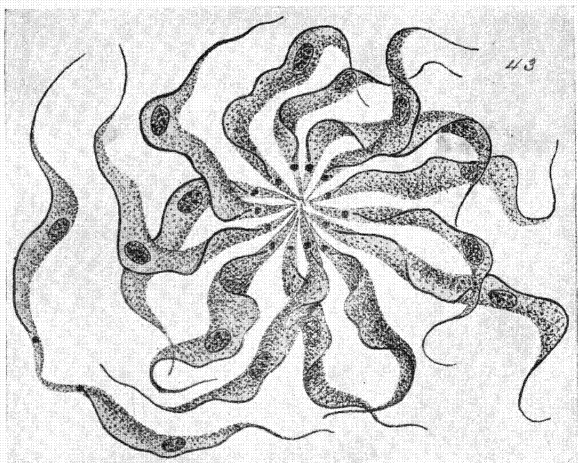


FIG. 66.

Nos. 43-44.—Showing union of two *Trypanosoma*: 43, primary agglomeration; 44, secondary agglomeration. (After Salmon and Stiles, 1902, Pl. II.)



FIG. 67.

Nos. 45-47.—*Trypanosoma* of *surra americana* (*equinum*), showing phases of agglomeration; 45, two *Trypanosoma* united at posterior extremities, in a preparation made from the peritoneal exudate of a guinea pig twenty-four hours after intraperitoneal inoculation; 46, rosette formation produced by mixing equal parts of infected blood of one horse and serum of another some time before death from *surra americana*; 47, large agglomeration seen immediately after making the mixture above mentioned. (After Sivori and Lecler, 1902, Pl. 5.)

Laveran and Mesnil write: "The *Trypanosoma* of *nagana* sometimes unite; under certain conditions they form primary agglomerations in rosettes; rarely large secondary agglomerations, which are common in blood containing *Tr. lewisii*, are observed.

"These *Trypanosoma* united two by two would suggest conjugation, but this interpretation is not admissible, as the agglomeration is not observed in pure, fresh blood and is produced only under conditions which may be called abnormal. The number of individuals which agglomerate is exceedingly variable.

"In *Tr. brucei*, as in *Tr. lewirii*, the agglomerations may be seen to separate after varying lengths of time.

"We have seen agglomerations of *Trypanosoma* in the pure blood taken from the heart after one-half to one hour, in the peritoneal exudates after an injection of blood rich in *Trypanosoma* into the peritoneum of rats or mice, and in blood mixed with physiologic water after being preserved for twenty-four hours on ice or heated for half an hour at 41° C.

"On mixing in equal parts the defibrinated blood of a rat or mouse rich in *Trypanosoma* and the serum of a horse, we have obtained beautiful persistent agglomerations. The *Trypanosoma* separated at the end of a few hours. On mixing one part of the serum of a horse and ten parts of blood, no agglomerations were produced. The serum of the blood of a pig also gave beautiful agglomerations.

"The serum of a sheep mixed in equal parts with the blood of a rat or mouse rich in *Trypanosoma*, gave in one case a beautiful agglomeration; in another the agglomerations were not so beautiful and less persistent. The serum of a deer gave small, nonpersistent agglomerations.

"The serum of human blood did not show itself either agglutinative or microbicidal.

"The following sera mixed in equal parts with the blood of a rat or mouse rich in *Tr. brucei* did not show any agglutinative properties: The serum of a rat, normal or immunized against *Tr. lewisii* and agglutinative for these *Trypanosoma*; the serum of a normal chicken; the serum of a chicken inoculated several times with *Tr. brucei*; the serum of a normal goose, and the serum of a goose inoculated several times with blood rich in *Trypanosoma* of *nagana*.

"If there is added to a few drops of blood rich in *Tr. brucei* a drop of water slightly acidulated with acetic acid, *Trypanosoma* are seen to agglomerate and change their forms rapidly. On adding a drop of water slightly alkalized with soda, no agglomeration occurs.

"*Trypanosoma* when dead still tend to agglomerate, but the process then takes place very irregularly."

Hefferan, commenting on Laveran and Mesnil's statements regarding agglutination of *Tr. lewisii*, doubts the correctness of their observations, giving her reasons for so doing. (Centralb. f. Bakt., etc., Bd. 8, No. 22, May 26, 1902.)

Curry noted that parasites in infected monkey's blood mixed with human blood lost their motility in twenty minutes and agglutinated. Chicken's blood mixed with infected monkey's blood gave similar results.

Schilling states that in cattle immunized with the peritoneal exudate of dogs inoculated with infected blood, the serum killed the *Trypanosoma* on the fourteenth and fifteenth days, and in the hanging drop in from thirteen to twenty-five minutes, but he has little to say of agglutination.

On reviewing the work done on the agglutination of *Trypanosoma* it will be seen that results have been uncertain and inconstant, the subject being left in an unsatisfactory state.

Hefferan's criticisms of Laveran and Mesnil's work in this line, and the statement of Rabinowitch and Kempner that no agglutinations were obtained with their specific serum, throws doubt on all of the results.

So far our work has developed nothing convincing. We have seen the rosettes and other described figures of agglutination, but they have been too inconstant and have occurred under too many conditions to be of any very great significance. Circumstances under which these figures have at one time appeared have at other times produced no results, and they have even occurred under conditions which are not supposed to favor agglutination.

Our results in the agglutination of *Tr. evansi* by various substances described as producing this phenomenon have been at variance with much of the recent work done along this line and more in accord with Rabinowitch and Kempner's conclusions. We have not observed a single condition which constantly gave agglutination figures. Such results were obtained occasionally with various substances, but reactions indistinguishable from these sometimes occur in infected blood without any additions.

A cow was immunized with as much as 3,000 c. c. of infected blood and failed to produce a serum which would agglutinate *Trypanosoma* with any degree of constancy. Similar results were obtained with chicken and human sera as well as with those secured from numerous other sources. Various mixtures of these sera were likewise unsatisfactory. Several chemicals, such as thymol, turpentine, and chloral, would occasionally give what appeared to be agglutination, but no regularity could be observed.

After weighing all evidence in the case and applying our own results, we must conclude with several others that the so-called phenomenon of agglutination is of no value from a diagnostic point of view, and if it is in reality an agglutination, it is too uncertain in its occurrence to serve as an index of immunity or susceptibility.

Involution forms.—Involution forms are produced by surroundings unfavorable to the life of the parasite. Laveran and Mensil mention among the conditions which favor their production (1) the blood of rat rich in *Trypanosoma*, mixed with the serum of some other animal and kept for several hours in a hanging drop; (2) blood containing *Trypanosoma* and heated to 41° to 42° C. for one hour or more; (3) infected blood injected into the abdominal cavity or the conjunctiva of birds and withdrawn after one to three hours; (4) parasitic blood placed in an ice box or in some other way subjected to freezing, and (5) rat's blood containing *Trypanosoma* and treated with arsenic, etc.

The same authors give the following as the principal type of involution forms: Round, flask-shaped bodies, in stained specimens usually showing nuclei, centrosomes, and flagella. If dividing forms have assumed this shape, two nuclei, two centrosomes, and two flagella may be seen. These bodies may form small agglutinations, and it is probable that the latter are what Plimmer and Bradford call plasmodic forms. Flask-shaped *Trypanosoma* are not always dead when not moving, as they may still be capable of conveying the disease to rats.

Trypanosoma in dying undergo profound alterations: (1) The protoplasm disappears and takes no color; (2) the shape is indicated only by a faint line of contour; (3) the nucleus stains faintly; (4) the protoplasm and nucleus disappear, leaving nothing but the flagellum and centrosome, and forming a knob at one end, and (5) the flagellum may be found alone or attached to the centrosome.

Figures 68, 48 to 69, 51, illustrate some of the involution forms given by various authors, and figs. 70, 52 to 59 others which have been observed in our work.

Distribution in the body.—The great majority of writers agree that *Trypanosoma* in an infected animal are found in all the body juices, and are not present at the same time in enormous numbers in one part of the body with but few in another. Animals having many parasites in the blood, when killed show them also in the organs; but if they are not demonstrable by microscopic examination in the former, they are also not found in the latter. The blood of animals suffering from the disease is always infectious by animal inoculation, although there are periods during its course when the parasites can not be found for days by microscopic examination. Plimmer and Bradford, and others state that the lymphatics near the point of inoculation first show the parasite, and that the animal's blood may be infectious for two days before the parasites are found therein.

There are, however, a number of writers who do not accept the general statement given above, but who believe the parasites to be more numerous in certain organs, such as the lymphatics and the bone marrow, than in others. Martini regards the spleen, lymphatics, bone marrow, and to a less extent, the liver and kidneys, as the places for the destruction of *Trypanosoma*.

Elaborate experiments have been performed to show whether or not reproduction occurs in any special organ, but practically without success.

It has repeatedly been shown that a hyperplasia of the lymphatics occurs to a greater extent in an animal inoculated after splenectomy than in one on which this operation has not been performed. Here again we revert to Voges's statement that the whole cycle of the parasite is acted out in the blood; and it would seem that the experiments conducted to determine the place of multiplication in the body tend to support this statement. It is certainly true that the *Trypanosoma* are pretty evenly distributed in the body juices and that similar forms are found in all parts.

It seems to be a very generally accepted opinion that *Trypanosoma* inoculated into the peritoneal cavity undergo a considerable multiplication before entering the circulating blood, and by some this time has been considered as constituting the true period of incubation.

Parasites in the dead body.—*Trypanosoma* live only a short time in the body after death. Within two hours signs of degeneration begin; the parasites shrink, assume irregular shapes, and then disappear. Motile parasites are not found two hours post-mortem. Ample work fully demonstrating this important point has been done. In exceptional cases living parasites have been found as late as sixteen hours after

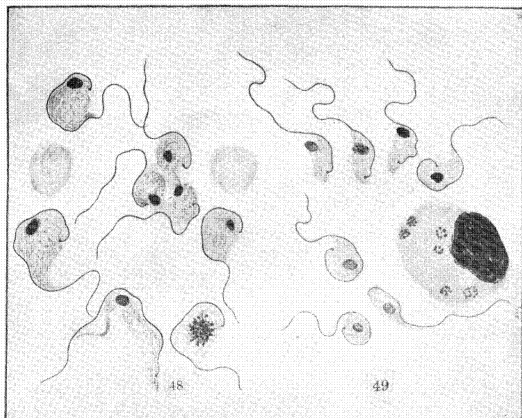


FIG. 68.

Nos. 48-49.—Involution forms of *Tr. equinum*. 48, Involution forms seen in horse twenty-four hours after recovery; 49, involution forms seen in the blood of a horse twenty-four hours after death. Large mononuclear cells containing parts of *Trypanosoma*. (After Sivori & Lecler, 1902, Pl. 6.)

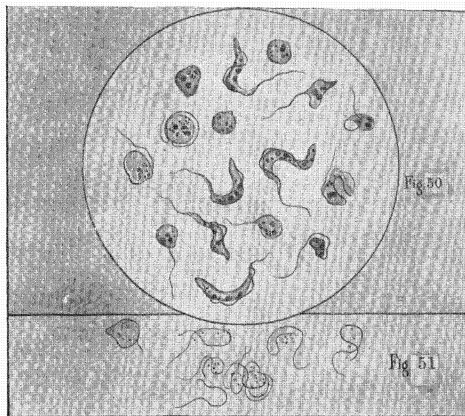


FIG. 69.

Nos. 50-51.—50, *Trypanosoma* of mal de cadéras mixed with serum of chicken and preserved on ice for six days, maintaining their vitality; several have assumed abnormal forms; all have their nuclei reduced to large granulations; stained according to Laveran; 51, *Trypanosoma* in the process of destruction; the free filaments have no centrosomes. (After Lignières, Recueil de Méd. Vét., vol. 10, No. 2, Jan. 30, 1903, Pl. II.)

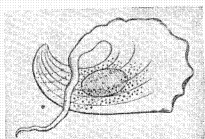
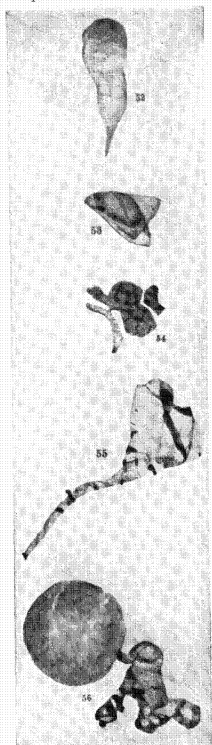


FIG. 71.

Tr. sanguinis Gruby. (After Doflein, 1901, fig. 32).

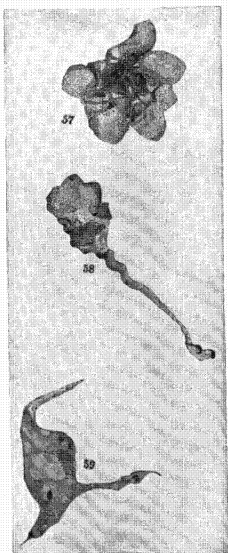


FIG. 70.

Nos. 52-59.—Involution forms of *Tr. evansi* Philipps.

death; but this condition is rare. Our work in this line has consisted in determining the longest time post-mortem during which the blood could be proved infectious by inoculation into susceptible animals. Results are conclusive that this is rarely greater than twenty-four hours. However, in one instance blood has been found to convey the disease forty-eight hours after death.

When an animal in the blood of which *Trypanosoma* are present dies, the parasites are then found in all the organs; and conversely, where none appear in the former, they are also absent in the latter. They are generally distributed, and multiplication forms do not appear in exceptional numbers in any one organ; however, they are usually somewhat more numerous in the spleen, liver, and lymphatic glands than in the bone marrow, and are seldom present in the medullary canal. They are found in the serous fluids and exudates of the joints, but rarely in the urine.

Schilling's results were somewhat exceptional. He says that "*Trypanosoma* were not found in the spleen when positive in the blood, and the peritoneal exudate and bone marrow showed parasites of a budding form;" and again "that *Trypanosoma* might be absent from the fluids and tissues, but were constantly present in the bone marrow." "The number of parasites in the spleen varied greatly, but there was never a great accumulation or multiplication of forms." He draws the conclusion that multiplication of parasites occurs in certain organs while others destroy them.

Trypanosoma outside of the body.—Although *Trypanosoma* in a natural condition are not known outside the body and propagate only to a minimal degree in any known artificial media, yet under favorable conditions they can be kept for a considerable time outside the body, a fact which has been believed to afford certain diagnostic points for different species. Berg kept *Trypanosoma* of fish for six days in blood at 12° C., and Mitrophanow from three to four days in salt solution. Laveran and Mesnil showed that during warm weather living forms of *Tr. lewisii* were found in blood which had been maintained at room temperature for four days. Once, during cold weather, motile parasites added to chicken's or pigeon's blood in a hanging drop were observed after eighteen days. Kept on ice and in blood mixed with physiologic water, they were observed during thirty to fifty-two days, the blood at the end of this time being virulent. They withstood 41° C. very well, but when heated to 50° C. for five minutes were all killed.

Voges states that outside the body *Trypanosoma* of mal de caderas disintegrated rapidly, blood usually being noninfectious after from three to four days. However, he noted one exception where infection occurred with blood which had been kept aseptically for fourteen days. Several writers have tried to attenuate *Trypanosoma* with formalin, heat, and several other means, but entirely without success. The parasites were either all killed so that no infection resulted, or they were as virulent as in control blood. *Tr. equiperdum* (*Elmassiani*) continued motile for forty-eight hours at a temperature of 36° C.

Laveran and Mesnil state that when human serum and blood containing *Trypanosoma* were mixed in equal parts in a hanging drop, the *Trypanosoma* showed feeble action in one-half to one hour, and generally were not motile at the end of two to three hours. Kanthack, Durham, and Blandford determined *Tr. evansii* to be destroyed by complete drying; they also demonstrated four days as the greatest length of time during which they could live in aseptically drawn blood. Laveran and Mesnil, Voges, and others have shown that the blood of an animal infected with *Trypanosoma* was not capable of transmitting the disease after twenty-four hours.

Martini states that the warm stage does not increase the life of *Trypanosoma* in vitro. He noted a bunching of parasites in dead bodies, and considered this a form which they assumed on dying.

Laveran and Mesnil state that the serum of immune deer, mixed in the hanging drop with infected blood, showed no parasitocidal action; and this was found to be true with most other sera. Infectious nagana blood exposed to a temperature of 41° C. for one hour showed deformed and nonmotile parasites, but was still capable of transmitting the disease. Exposure to a temperature of 41° C. and 44° C. for a short time killed the *Trypanosoma* and the blood was no longer infectious.

Many chemical substances quickly destroy the parasites outside the body. Laveran and Mesnil report that they were rapidly killed by the newer silver salts, and that a 1 per cent solution of Toluidin blue attenuated them somewhat, as was shown by the prolonged incubation period. Sivori and Lecler consider the life of the parasite in vitro to be variable, depending upon the conditions produced, but never reaching four days. Schilling noted that *Trypanosoma* were soon destroyed by a 60 per cent solution of bile.

Bruce showed that dried blood was infectious after twenty-four hours in one out of three experiments, with an incubation period of sixteen days. In two cases it was

not infectious at the end of forty-eight hours. Aseptically drawn virulent blood was infectious for four days and after seven did not produce the disease.

Laveran and Mesnil state that the movements of *Trypanosoma* are retarded by cooling and accelerated by warming the blood in which they are contained. They were not immediately killed by a temperature of 50° C. to 55° C. below zero. Their experiments were as follows:

Experiment I.—Rat blood with many *Tr. brucei* diluted with potassium citrate solution and kept at 18° C. for one-half hour. One and one-half hours after returning to room temperature it still showed many normal-looking motile *Trypanosoma*. Mice injected in the conjunctiva with this blood died in the usual time with trypanosomiasis.

Experiment II.—Similar dilutions of blood exposed twenty minutes to 15° C. and eight minutes to 25° to 30° C. After two hours warmed blood showed normal-looking motile *Trypanosoma* and was infectious in the usual time for mice.

Experiment III.—Similar solution of blood exposed for one-half hour at 15° C. and five minutes at 50° to 55° C. After two hours the thawed and warmed blood contained normal-looking and motile *Trypanosoma* and was infectious for mice in the usual time.

Experiment IV.—Same as No. 3, except that the freezing and thawing was repeated. It was still pathogenic for mice, but was slightly slower in its action.

These authors demonstrated that blood infected with *Tr. brucei* heated three hours at 40° C. or one hour at 42° C. was still virulent. Blood infected with *Tr. brucei* heated twenty minutes at 40° C. to 44° C. killed nearly all the *Trypanosoma*, and when heated to 44° C. to 45° C. all the parasites were quickly destroyed.

Blood taken aseptically and mixed with citrate solution at room temperature, according to Laveran and Mesnil, was virulent for three days, and *Trypanosoma* lived longer in a mixture of blood and serum than in blood alone. In the defibrinated blood of a rat mixed with the serum of the host motile *Trypanosoma* were still observed after three days.

Human serum and that of refractory animals was not considered less adapted to the preservation of *Trypanosoma* than that of more susceptible animals. *Tr. lewisii* lived longer on ice than at room temperature, but this was not true of *Tr. brucei*. Blood containing *Tr. brucei*, after being kept on ice for three to five days, was often noninfectious, though it still contained slightly motile *Trypanosoma*. Involution forms quickly appeared in blood kept on ice, their morphology differing in no respect from that of the involution forms produced by other causes.

We have experimented extensively with the object of determining the length of life in vitro of the *Trypanosoma* with which we have been able to work, and on the whole have obtained results similar to those arrived at by most recent writers on other *Trypanosoma*.

Our experiments made to determine the action of heat and cold on parasites confirm, in the main, the conclusions drawn by Laveran and Mesnil, including the differentiation of *Tr. lewisii* by its ability to live longer than *Tr. evansii* in the ice box. We failed to find any constancy in the agglutinations these authors describe. They did occasionally occur, following exposure to conditions especially adverse to life; but they were not constant and also took place in the hanging drop. We can not attach to this phenomenon the importance given it by some authors.

Several specific sera mixed in the hanging drop in equal parts with blood rich in *Trypanosoma* gave no appreciable results, with the possible exception of the mixtures containing antiplague and antirinderpest sera. The *Trypanosoma* were usually nonmotile in the plague serum at the end of forty minutes, and in the rinderpest serum sometimes as early as thirty minutes. In two out of five experiments made with the latter the blood was noninfectious for rats at the end of one hour. In most of the experiments made with serum the parasites lived as long as in the control drop, and in some instances much longer.

A 1-500 solution of quinine mixed in equal parts with blood containing *Trypanosoma* arrested the motility of the parasites in from five to ten minutes. With a 1-1,000 solution of methylene blue the *Trypanosoma* lost their motility from five to twenty minutes earlier than in the control. They are less affected by solutions of alcohol, glycerin, or ether.

No perceptible action was produced on the *Trypanosoma* by mixing the infected blood with equal parts of the following substances: A 1-1,000 solution of acetozone; 1-1,000 solutions of the soluble eosins, alcohol, potassium acetate, potassium chlorate, potassium cyanide, salt solution, picric acid, oxalic acid, and the chlorides of magnesium, calcium, and barium. Indeed, in many of these solutions the parasites remained active longer than in control.

The *Trypanosoma* were quickly destroyed by mixing infected blood in the hanging

drop with equal parts of the following substances: A 1-1,000 solution of arsenious acid, a 1-1,000 solution of turpentine, a 1-1,000 solution of corrosive sublimate, a 1-500 solution of chloral hydrate, a 1-500 solution of carbolic acid, a 1-500 solution of formalin, a 1-1,000 solution of potassium permanganate, and a 1-200 solution of quinine.

CLASSIFICATION.

Authors differ considerably in the classification of this family of the *Protozoa*.

Doflein, 1901, divides the genus *Tr. Gruby* into three subgenera, as follows:

1. Major flagellum present..... 2
Major flagellum absent, or very short and thick..... *Trypanosoma*.
2. Undulating membrane continued posteriorly in a flagellum so that 2 flagella are present..... *Trypanomonas*.
Posterior flagellum absent, undulating membrane ending on or before end of body..... *Herpetosoma*.

Leveran and Mesnil, 1901, have shown Doflein's *Trypanomonas* to be a distinct genus and have given it the name *Trypanoplasma*, with *Trypanoplasma borreltii* as a type species.

Salmon and Stiles criticise Doflein's classification and divide the family *Trypanosomidae* into two genera—*Trypanosoma* and *Trypanoplasma*. With a few minor changes, this classification is adopted tentatively in this report. However, as will be seen by following the discussions, we are strongly of the opinion that at least two of the parasites of mammals, and probably others, are identical with *Tr. evansii*, and in reality the names of these should fall as synonyms of *Tr. evansii*.

PROTOZOA, class Mastigophora, subclass *Flagellata*, order Monadida, family Trypanosomidae, genus *Trypanosoma* Gruby.

Trypanosoma: One flagellum present extending from the centrosome along the undulating membrane and becoming free at the anterior extremity.

Trypanoplasma: Two flagella, one extending anteriorly and the other posteriorly.

Trypanosoma rotatorium Mayer, 1843; L. & M., 1901.

Synonyms: *Amæba rotatoria* Mayer, 1843, July; *Paramoecium loricatum* Mayer, 1843, July; *Paramoecium costatum* Mayer, 1843, July; *Trypanosoma sanguinis* Gruby, 1843, November; *Globularia radiata sanguinis* Wedl, 1850; *Undulina ranarum* Lankester, 1871; *Herpetomonas* Kent, 1880; *Paramocioides costatum* Grassi, 1881; *Paramocioides costatus* Grassi, 1883; "*Trypanosoma sanguinis* Gruby" of Lanessan, 1882; "*Globularia radiata* Wedl, 1849" of R. Blanchard, 1885; *Haemetomonas* Mitrphanow, 1883; *Trypanomonas ranarum* Danilewsky, 1885; "*Spirochæte* of Steele," 1885; "*Hemotomonas*" of Blanchard, 1888; "*Trichomonas sanguinis*" of Crookshank, 1886; *Trypanosoma ranarum* (misprint for *ranarum*) 1889; *Trypanosoma costatum* Danilewsky, 1889; *Trypanosoma costatum ranarum* Danilewsky, 1889; *Trichomonas ranarum* (Lankester) Danilewsky, 1889; *Trichomonas batrachorum* Danilewsky, 1889; "*Trypanosomes* Gruby" of Laveran, 1895; "*Trypanosomum*" Chauvrat, 1896; "*Trypanosome* Gruby" of Buffard and Schneider, 1900; "*Paramoecium loricatum* Mayer" and "*Paramocioides costatus* Grassi" of Laveran and Mesnil, 1901.

Trypanosoma avium Danilewsky, 1885, of birds.

Synonyms: *Trypanosoma avium* Danilewsky, 1885; *Trypanosoma fusiforme* Danilewsky, 1889; *Trypanosoma minus* Danilewsky, 1889; *Trypanosoma majus* Danilewsky, 1889; *Trypanosoma sanguinis avium* Danilewsky, 1889; *Trypanosoma costatum* Danilewsky, 1889; *Trypanosoma major* Danilewsky, 1889.

? *Trypanosoma eberthii* Kent, 1880, of fowls (intestine).

Synonyms: *Trypanosoma eberthii* Kent, 1880; "*Trypanosoma eberthii*" of Lanessan, 1882; ? *Cercomonas gallinarum* Davaine, 1877; ? *Cercomonas gallinae* Rivolta, 1880; *Trypanosoma eberthi* of Lecerliq, 1890; *Trichomonas columbarum* Kruse, 1896.

Trypanosoma cobitis Mitrphanow, 1883, of mudfish.

Synonyms: *Hæmatomonas cobitis* Mitrphanow, 1883; *Trichomonas cobitis* (Mitrphanow) Crookshank, 1886; *Trypanosoma piscium* Danilewsky, 1885; *Trypanosoma (Herpetosoma) cobitis* (Mitrphanow) of Doflein, 1901; *Hæmatomonas cobitidis* Luehe, 1902.

Trypanosoma carassii Mitrphanow, 1883, of fish.

Synonyms: *Hæmatomonas carassii* Mitrphanow, 1883; *Trichomonas carassii* (Mitrphanow) Crookshank, 1886; *Trypanosoma piscium* Danilewsky, 1889; *Trypanosoma fusiforme* Danilewsky, 1889; *Trypanosoma (Herpetosoma) carassii* (Mitrphanow) 1883, Doflein, 1901.

Trypanosoma soleae Laveran and Mesnil, 1901, of soles.

Trypanosoma balbianii Certes, 1882, of oysters.

Synonyms: *Trypanosoma balbianii* Certes, 1882; *Trypanosoma balbianii* (Certes) Balbiani, 1888; "*Trypanosoma balbianii*" of Danilewsky, 1889.

Trypanoplasma danilewskyi Labbe, 1891.

Synonyms: *Trypanomonas danilewskyi* Labbé, 1891; *Trypanosoma* (*Trypanomonas*) *danilewskyi* (Labbé) Doflein, 1901.

Trypanoplasma borrelui Laveran and Mesnil, 1901.

Trypanosoma lewisii Kent, 1880, of rats.

Synonyms: *Herpetomonas lewisi* Kent, 1880; "*Herpemonas lewisi* Kent," 1880; *Trichomonas lewisi* (Kent) Crookshank, 1886; *Herpetomonas lewisii* Danilewsky, 1889; *Trypanomonas murium* Danilewsky, 1889; *Trypanomonas lewisi* (Kent) Labbé, 1891; *Trypanosoma lewisi* Kent; *Trypanosoma* Kanthack, Durham and Blandford, 1898; *Trypanosoma rattorum* Boerner, 1901; *Trypanosoma* (*Herpetosoma*) *lewisi* (Kent) Doflein, 1901.

Trypanosoma evansi; Steel, 1885, of surra.

Synonyms: (Genus not named) *ferox* Evans, 1881 (not entitled to priority); *Spirocheate evansi* Steel (not accessible); "*Spirochaeta evansi* Steel," 1885, of Crookshank, 1886; *Hæmatomonas evansi* (Steel) Crookshank, 1886; *Trichomonas evansi* (Steel) Crookshank, 1886; "*Homotomonas evansii*," Blanchard, 1888; "*Trichomonas sanguinis* Crookshank" of Balbiani, 1888; "*Spirochaeta evansii*" of Nariman and Vaz, 1893; "*Spirochaeta evansii* Steel" of Laveran, 1895; "*Trypanosomum evansi* (Steel) Chauvrat," 1896; *Trypanosoma evansi* (Steel) Pease, 1897; *Trypanosoma evansii* Pease, 1897; *Herpetomonas lewisii* Steel, of Danilewsky, 1889; *Trypanosoma* (*Herpetosoma*) *evansi* (Steel) Doflein, 1901; "*Trichomonas sanguinis evansi* Crookshank" of Doflein, 1901.

Trypanosoma brucei Plimmer and Bradford, 1899, of tsé-tsé disease.

Synonyms: *Trypanosoma brucei* Plimmer and Bradford, 1899; "*Trypanosoma brucei*" of Schneider and Buffard, 1900; *Trypanosoma* (*Herpetosoma*) *brucei* Plimmer and Bradford, of Doflein, 1901; *Herpetomonas brucei* (Plimmer and Bradford) Laveran and Mesnil, 1901.

Trypanosoma nepbeui, of man.

Synonyms: *Trypanosoma gambiense* Dutton, 1902; *Trypanosoma fordii* Maxwell, Adams, 1903.

Trypanosoma rougetii Laveran and Mesnil, of dourine.

Synonyms: *Trypanosoma equiperdum* Doflein, 1901, July 1; "*Trypanosoma*" (*Herpetosoma*) *equiperdum* Doflein, 1901; *Trypanosoma* (*Hæmatomonas*) *equiperdum* Doflein of Luehe, 1902.

Trypanosoma equinum Voges, 1901, of mal de caderas.

Synonyms: *Trypanosoma equinum* Voges, 1901; *Trypanosoma equinum* Voges of Railliet, 1901; *Trypanosoma elmassiani*, 1902.

Trypanosoma therrellii Laveran and Mesnil, 1901, of cattle.

Trypanosoma transvaaliense Thuiler, Laveran and Mesnil, 1902, of cattle.

Trypanosoma rotatorium MAYER, 1843.

The length of this parasite, including the flagellum (which is 10 to 12 microns long), is usually given as being about 40 to 80 microns, while the breadth is 5 to 10 microns. Doflein says it has a broader body and undulating membrane than most of the other *Trypanosoma*. It has a granular protoplasm and a large, clear nucleus. One end is somewhat blunt and the other is provided with a short flagellum.

Salmon and Stiles, in their specific diagnosis of this parasite, after giving the dimensions, state that "the body is compressed, semilunate, twisted; the convex border membranous and undulating; the posterior extremity of the body portion pointed and curved inward, the opposite one produced into a long tag or tail-like appendage, which almost equals in length the remainder of the body; surface of the body coarsely striate longitudinally; endoplasm or parenchyma slightly granular; endoplast ovate, central."

Habitat.—Blood of frogs (*Rana esculenta*, *Rana temporaria*, and *Rana arborea*).

According to Doflein, the mode of transmission is not fully determined, and this statement is confirmed by Laveran and Mesnil. There may be more than one species of this parasite, but so much of the work regarding it is unsatisfactory that for the present it seems advisable to consider it a single species. It apparently has no special pathologic significance, and for that reason is of but little importance in this paper.

We have examined the blood of a large number of several varieties of frogs here, but have failed to find this or any other *Trypanosoma*.

Trypanosoma avium Danilewsky, 1885.

Salmon and Stiles give as its specific diagnosis: "*Trypanosoma* 18 to 60 microns long; body cylindrical, compact, fusiform, and homogeneous; anterior extremity gradually attenuate, and continuing directly into a long or short flagellum; flagellum

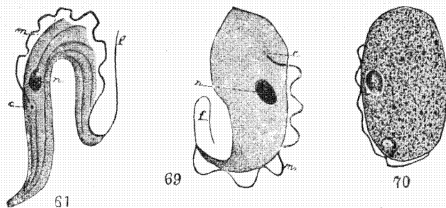


FIG. 72.

Nos. 61, 69, 70.—Showing different forms of *Tr. rotatorium*. *f*, Flagellum; *m*, undulating membrane; *n*, nucleus; *c*, centrosome. (After Laveran and Mesnil, 1901, figs. 1-3.)

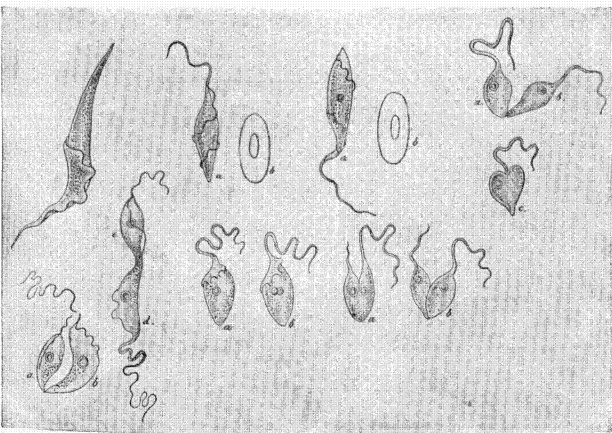
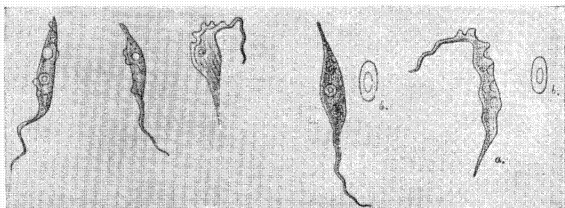


FIG. 73.

Various forms of *Trypanosoma* of birds. (After Salmon and Stiles, 1902, figs. 53-64.)

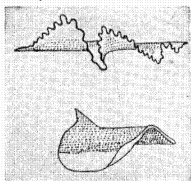


FIG. 74.

Tr. eberthii. (After Doflein, 1901, fig. 33.)

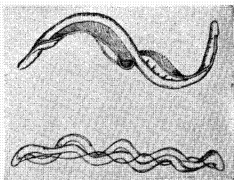


FIG. 75

Tr. balbianii Certes. (After Lustrac.)

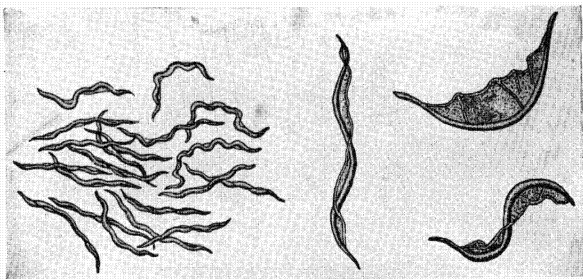


FIG. 76.

Tr. balbianii Certes. (After Salmon and Stiles, 1902, figs. 76-79.)

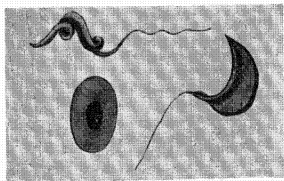


FIG. 77.

Tr. cobitis Mitrophanow. (After Mitrophanow.)

intimately united with the undulating membrane, which extends from the flagellum to the posterior extremity; nucleus spherical in equator or anterior half of body."

There have been found in literature several references reporting *Trypanosoma* in birds, but most of the descriptions are inadequate. We have examined a large number of birds of several varieties in the Philippine Islands, but we have failed to find *Trypanosoma* in their blood, and have been entirely unable to infect them with the *Trypanosoma* with which we have worked.

? Trypanosoma eberthii Kent, 1880.

Salmon and Stiles and others doubt the correctness of the classification of this species; Doflein believes that two or three species have been confused in its description.

It is described by Doflein as half-moon in shape, the concave side being the body of the parasite, and the convex the undulating membrane, which has numerous small folds. The protoplasm is homogeneous and contains a nucleus. One end of the body is blunt, and the other is tapering and continues into a short, motionless projection. Kent says that the membranous border is often spirally convoluted around the thicker central portion, the entire body under such conditions assuming a auger-like aspect.

Habitat.—Glands of Lieberkühn, cecum and ileum of chickens, doves (?), ducks, and geese. Rivolta and Pfeiffer, according to Doflein, found this organism, or a similar one, in poultry diphtheria.

In the few chickens, pigeons, and small birds which we have examined in Manila, these parasites have not been found. It seems more than likely that some of the *Trichimonidæ* have been mistaken for *Trypanosoma*, as it is doubtful that so strict a blood parasite would be found in the intestinal canal of birds.

Trypanosoma balbianii Certes, 1889.

Doflein gives the length of this parasite as 50 to 180 microns and the breadth as 1 to 3 microns. Salmon and Stiles give the length as 50 to 18 microns and the breadth as 1 to 30. It is described by Doflein as an elongated parasite with slender body and slender undulating membrane. Certes, Lustrac, and others have observed longitudinal division, which Lustrac says begins in the undulating membrane. Laveran and Mesnil do not consider this parasite a member of the family *Trypanosomidæ*.

Habitat.—Intestines of oysters (*Ostra edulis*, *Ostra angulata*, *Grypha angulata*) and mussels (*Tapes decussata*, *Tapes pallustris*).

Pathogenesis.—Not known.

Neither this nor any other *Trypanosoma* has been observed by us in the examination of a large number of oysters of the Philippine Islands.

Trypanosoma cobitis Mitrophanow, 1883.

A very active and motile *Trypanosoma*, 30 to 40 microns long by 1 to 1.5 microns broad. Doflein says that one end tapers abruptly and the other gradually, ending in a flagellum 10 to 15 microns in length. The undulating membrane is distinct in prepared specimens. The protoplasm is homogeneous, except, according to Doflein, in multiplication and degenerating forms, where it may be granular.

Habitat.—Blood of mudfish (*Cobitis fossilis*).

Pathogenesis.—Described experiments have failed to convey the infection from fish to fish, or from fish to animals, by inoculation.

Trypanosoma carassii Mitrophanow, 1883.

Doflein says that it is very similar to *Tr. cobitis*, but more flattened; that the undulating membrane is better developed and the body more uniformly pointed at both ends and larger than that of *Tr. cobitis*.

Habitat.—Blood of fish (*Carassius vulgaris*). Doflein observed it or very similar parasite in the tench (*Tinca vulgaris*).

Pathogenesis.—Not known. The *Trypanosoma* which Doflein observed were found in sick fish.

The fish of the Philippine Islands are apparently free from this *Trypanosoma*.

Trypanosoma remakii Laveran and Mesnil, 1901.

Trypanosoma 28 to 30 microns in length and very slender. Two sizes and possibly two varieties. Very closely resembles *Tr. lewisii*, actively motile, with undulating membrane, both ends tapering with a long flagellum at the anterior end, protoplasm

finely granular. The larger forms measure 45 microns in length and 2 to 2.5 microns in breadth, and stain somewhat better than the small variety.

Habitat.—Blood of pike (*Esox lucius*).

Pathogenesis.—Not infectious by inoculation.

We have not succeeded in finding *Trypanosoma* in the blood of fish in the Philippine Islands, although several varieties of both salt and fresh water fish have been examined.

Trypanosoma soleæ Laveran and Mesnil, 1901.

A *Trypanosoma* resembling *Tr. lewisii* 40 microns in length, very actively motile, structure in general like that of the other members of the family, posterior end not so sharp, nucleus oval, centrosome present and undulating membrane well developed.

Habitat.—Blood of sole (*Solea vulgaris*) of France.

Pathogenesis.—Laveran and Mesnil did not succeed in infecting other animals with this *Trypanosoma*.

Trypanoplasma borrelii Laveran and Mesnil, 1901.

Laveran and Mesnil describe this parasite as a *Trypanoplasma*, with two flagella both extending from the centrosome and one going to each extremity, the anterior one bordering a well-defined undulating membrane and extending into a free flagellum 15 microns in length. The total length of the parasite with flagella is about 50 microns and the breadth 3 to 4 microns. One end is more pointed than the other and very motile. This parasite changes its form, sometimes resembling an ameba. Two chromatin masses lie close together near the junction of the posterior and anterior parts of the body, one of these masses resembling a nucleus and the other a centrosome.

It is to be noted here that Labbé (1891) had already seen a *Trypanoplasma* with two flagella in the blood of leeches, and that Künstler (1898) had mentioned a similar organism found in the blood of a guinea pig. Figure 81-89 is Labbé's illustration of the parasite observed by him in leeches in 1891.

Habitat.—Found by Laveran and Mesnil in the blood of the redeye (*Leuciscus erythrophthalmus*) of France.

Pathogenesis.—Not infectious by inoculation.

Trypanosoma lewisii Kent, 1880.

Gros in 1845, Chaussat in 1850, and later other authors found remarkable parasites, which for a long time were the cause of controversy, in the blood of rats and hamsters. While some considered them as amebæ, flagellates, etc., there were others who did not recognize them as independent organisms, but as spermatozoa, or as Siebold even considered them small patches that somehow had been torn loose from the walls of the circulatory and lymphatic systems.

After a long pause interest in this organism was again aroused, and a large number of articles dealt with the subject, without mentioning or recognizing the earlier works. Lewis (1879 and 1880), Wittich (1881), Robert Koch (1881), Crookshank (1887), published several treatises on *Tr. lewisii*, to which Kent in 1882 gave its name; but he placed it in the genus *Herpetomonas*, which according to diagnosis accepted at present possesses no undulating membrane. With less exactness, Labbé, Danilewsky, and Mitrophanow also dealt with the species, while all investigators of surra likewise refer to it. Interest was awakened through the investigations of surra and tsetse-fly disease, and has recently been increased by the observations of Koch, Rouget, and others, but especially by the important works of Rabinowitch and Kempner, Wasielewski and Senn, and Laveran and Mesnil which explain the methods of multiplication and widen our knowledge considerably.

Rabinowitch and Kempner, as well as Wasielewski and Senn, have studied multiplication forms with a considerable degree of thoroughness. Their investigations agree on essential points. According to them there are three kinds of multiplication; two forms of division and one form of multiplication through segmentation, a division into numerous rosette-shaped sprouts lying side by side.

Whether conjugation takes place is yet unknown, but to Doflein it appeared that such a process precedes the multiplication by division into sprouts. Some pictures of Rabinowitch and Kempner point to such a course. This, however, is still very problematical, especially since the life history of *Trypanosoma* is not fully understood.

Senn, for example, considers the ordinary division as budding, since, according to his statement, the mother parasite is always larger than the daughters produced by her. The individuals are seen rapidly to increase, especially after a new infection,

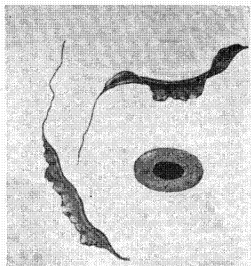
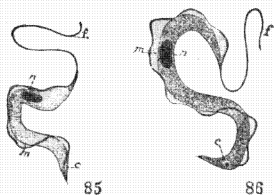


FIG. 78.

Tr. carassii Mitrophanow. (After Mitrophanow.)



FIGS. 79, 80.

Nos. 85-86. 85, *Tr. remakii parvum*; 86, *Tr. remakii magnum*; f, flagellum; m, undulating membrane; c, centrosome; n, nucleus. (After Laveran and Mesnil, 1901, fig. 3.)

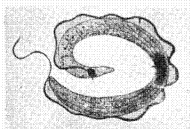


FIG. 81.

Tr. solei. f, flagellum; m, undulating membrane; c, centrosome. (After Laveran and Mesnil, 1901, fig. 3.)

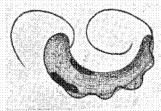


FIG. 82.

Trypanoplasma borellii. (After Laveran and Mesnil, 1901, fig. 4.)

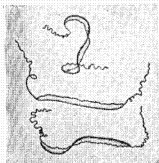


FIG. 83.

Trypanoplasma danilewskyi Labbé. (After Salmon and Stiles, 1902, fig. 83.)

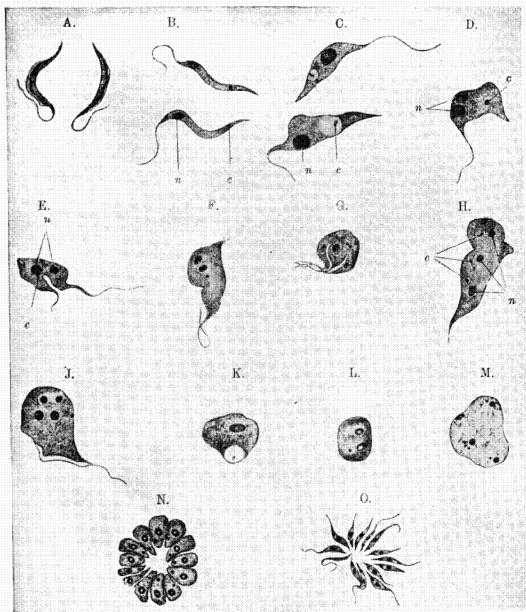


FIG. 90.

Tr. lewisii Kent. A, adult living parasites; B, adult stained parasites; C-F, stages of longitudinal division; G, multiple longitudinal division; H, beginning multiple transverse division; I-M, other forms of division; N-O, rosette forms of division; n, nucleus; c, centrosome. (After Rabinowitsch and Kempner.)

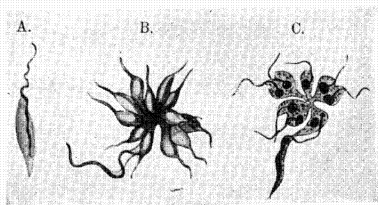


FIG. 91.

Tr. lewisii Kent. A, adult parasite; B, multiplication forms in fresh specimen; C, multiplication forms in stained specimen. (After Wasielewsky and Senn.)

impetuously dividing themselves. The divisions are often multiple, and the mother is seen to separate into two, three, four, and even eighteen daughters. Senn considers the rosette formation to be the result of a division into several individuals, and not as a special form of multiplication; but since the complete life cycle of the species has not been positively determined, this is also a mere theory.

In any case separation into two parts is the typical form of longitudinal division, and the apparent deviations in prepared specimens are explained by the delicacy of the protoplasm, which on being killed assumes the most varied forms. As yet resting forms have not been observed.

Habitat.—This species lives in the blood of rats (*Mus rattus*, *Mus decumanus*, *Mus refuscens*) and in that of the hamster (*Cricetus arvalis*). Thus far it has been observed in Europe (Germany, England, France, Italy, and Russia), in Asia (India, Japan, and the Philippines), and in Africa (Dutch East Africa and Algiers).

Pathogenesis.—The parasite is found in the blood of animals attacked by the disease. In the case of rats it sometimes produces sickness and death, but it is generally found in apparently healthy animals. Wild rats are often found infected with it, but in tame ones, especially in the white variety, its occurrence is rare, although these as well as white mice are susceptible to the disease. In many instances 25 to 29 per cent, but in others a much smaller percentage of wild rats has been found infected. Under certain conditions epidemics seem to break out.

Whether the *Trypanosoma* which appear in hamsters and those found in rats are identical can not yet be stated positively.

This parasite is very common in rats in numerous places both in the trypanosomatic zone and in countries which have apparently always been free from the disease in domestic animals. For the purposes of study it is one of the most easily obtainable, and because of its nonpathogenic significance and its very close relation to the more virulent forms is one of the most important of the genus. The history and synonyms recognized by leading authors have been given above.

Salmon and Stiles give as the specific diagnosis:

"Eight to 10 microns long by 2 to 3 microns broad; 24 to 25 microns long by 1.4 microns broad (Laveran and Mesnil, 1901); a very refringent granule (near centrosome) in place of which a clear vacuole is seen in stained preparations. 'Animalcules exceedingly minute, attenuate and vermicular under normal conditions, but highly polymorphic and capable of assuming a variety of contours; flagellum single, terminal, two or three times the length of the extended body; no contractile vesicle * * * as yet detected.'"

Doflein's description translated reads as follows:

"The *Trypanosoma* of rats is lance-shaped and reveals a very finely granular protoplasm, around which a thin hyaline but clearly visible entoplasm lies. From the latter spring the flagellum and the undulating membrane. The flagellum is almost as long as the body itself, and springs from the posterior end of the parasite with a central nucleus-like structure considered as its origin, and then continues as a thickening of the edge of the undulating membrane, first becoming free at the anterior end of the parasite and wriggling about in the medium surrounding it. In the anterior part of the parasite is found the somewhat large nucleus, staining deeply and filled with a dense chromatin network. A contractile vacuole has not been seen. The length of *Tr. lewisii* varies between 8 and 10 microns and the breadth between 2 and 3 microns."

As is true of other parasites, *Tr. lewisii* undoubtedly shows variations in size. Individuals are found not measuring more than 15 to 20 microns in length by 1 to 2 microns in breadth. On the other hand, specimens are seen which may be fully 30 microns long and 3.5 microns broad. The average measurements of adult parasites observed in Manila rats, obtained from hundreds of specimens, are 25 microns long by 2.5 microns broad.

On the whole the motility of this parasite in the hanging drop is probably greater than that of any other *Trypanosoma*. The active darting motion observed is not characteristic of all specimens, and we have been unable to determine the responsibility of outside influences for these variations.

In addition to *Tr. lewisii*, Manila rats certainly harbor *Tr. evansii*, and we have not yet satisfied ourselves that there is not a third variety in some of them. This makes observations of *Tr. lewisii* based upon the examination of the *Trypanosoma* found in rats more difficult, and in the past has probably been responsible for the lack of harmony in results obtained.

Numerous comparisons of diagnoses made of rat *Trypanosoma* by morphological characteristics, and by those determined by animal experiments with the same organisms, have fully convinced us of the futility, in many cases, of depending upon microscopic data for the diagnosis of *Tr. lewisii* or of other *Trypanosoma*.

The most trustworthy and important diagnostic point for this parasite besides the animal test is the fact already brought out by others, particularly by Laveran and Mesnil, that it lives so long in the ice box, where in solutions of blood in potassium citrate *Tr. lewisii* retain their activity for days, and always longer than *Tr. evansii*, which on various occasions have been tested side by side with them. They not only retain their activity longer, but also remain infectious for rats for a much greater length of time.

This is not true, however, when compared with the possible third variety of rat *Trypanosoma* mentioned above. These are excessively motile, remaining so for a long time in the ice box, where they maintain their infectiousness. The supposition that these *Trypanosoma* belong to a separate species has been gradually evolved from experimental data. There have been times when we have felt confident we were working with *Tr. lewisii*, only to find the parasites infectious for dogs, monkeys, etc., after two or three days in the ice box. At present this point has not been satisfactorily determined and must be left to a future discussion.

Of this we are sure—that *Trypanosoma* corresponding in every respect to the descriptions given of *Tr. lewisii*, including their noninfectiousness for other animals, may be found in the blood of Manila rats. In addition to these, *Trypanosoma* correct in every essential for *Tr. evansii* occur in these rodents, as well as parasites which microscopically resemble *Tr. lewisii*, but are infectious for other animals, producing disease and death.

Trypanosoma evansii Steel, 1885.

A motile *Trypanosoma*, 20 to 30 microns in length by 1 to 2 microns in breadth, somewhat blunt at the posterior end and gradually tapering at the anterior end. The undulating membrane is well defined, beginning at or near a small body in the posterior portion of the parasite and extending forward as a free flagellum. This *Trypanosoma* is provided with a nucleus and a granular protoplasm.

We have classified the parasite causing *trypanosomiasis* in the Philippine Islands as *Tr. evansii*. It is the name adopted for the original organism causing the disease in domestic animals; and the one in the Philippine Islands answers the descriptions of this *Trypanosoma* as well as do some of the parasites later to be discussed.

It is a *Trypanosoma* from 20 to 30 microns long by 1 to 3.5 or 4 broad, including the flagellum. The gradually tapering anterior end is provided with a long flagellum, which in the living parasite has a very active motion and is a free continuation of the thickened border of the undulating membrane. It extends backward along this membrane to its end, about one-third to three-fourths the length of the parasite, and terminates at or near the centrosome (micronucleus). The undulating membrane extends from the posterior portion of the parasite along one border to the anterior, where it gradually tapers into the free flagellum. This membrane, active in the living parasite, in fixed specimens is found to be more or less folded, giving it a ruffled or fluted appearance. It is usually homogeneous, but sometimes contains granular matter apparently identical with that found in other parts of the parasite. The posterior end of the parasite is more or less blunt. In the living state this part is undoubtedly contractile, a fact which accounts for the varying degrees of bluntness seen in fixed specimens. Too much importance has been attached to the shape of this extremity, which in the parasites observed by us varies too much to be very significant as a diagnostic point.

The *protoplasm* of the parasite alters considerably with conditions, one of which is probably the age of the organism. In some it is almost homogeneous as viewed with a Zeiss 1/12 objective ocular 4. It is usually granular, especially in the anterior portion, the granules being either small or large, but more often of the two kinds. A number of the larger chromatin granules, which may measure as much as 1 micron, are often seen near the centrosome, again in the anterior portion, and sometimes well up into the flagellum. We have observed them a few times in the undulating membrane.

The nucleus is situated somewhat anteriorly to the center and is oval or round and of good size. A nucleolus is not usually observed. The nucleus takes a characteristic stain and is homogeneous or slightly irregular in structure; but we have been unable to bring out the beautiful effects of karyokinetic division illustrated by some authors.

The centrosome is situated in the posterior portion, its distance from the posterior end varying from one-fourth to one-third the length of the parasite, depending no doubt upon the degree of contraction of this part at the time of fixing. It is chromatic and within small limits varies in size. It is intimately associated with the beginning of the undulating membrane and flagellum, and while difficult to demonstrate satisfactorily is probably the head of the flagellum.

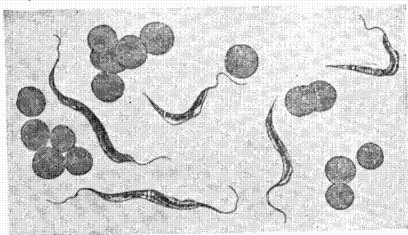
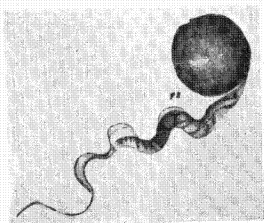
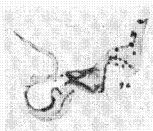
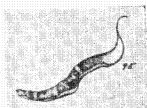
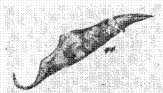
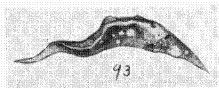


FIG. 92.



FIGS. 93-98.

In fresh specimens the parasite has an eel-like motion, owing to the vibration of the undulating membrane and flagellum, and to a less extent to the action of the entire parasite. The actual motility varies in some specimens, and, while it is generally not great, it may be quite extensive. These variations are difficult to explain, the more so since they occur in specimens prepared from the same animal at different times. For the study of structure, fixation and staining are necessary. The various methods which have been published for showing the motion of the living parasite in such a way as to reveal the structure are unsatisfactory.

Habitat.—The habitat of this *Trypanosoma* has already been given, but we wish to add Manila rats to the list. This fact merits especial emphasis in the consideration of measures for the control of the incurable malady caused by the parasite.

Pathogenesis.—It is pathogenic for nearly all animals, as will be seen when the discussion of susceptible animals is reached.

Trypanosoma brucei Plimmer and Bradford, 1899.

Laveran and Mesnil describe it as a *Trypanosoma* 26 to 27 microns long by 1 to $1\frac{1}{2}$ microns broad. In horses and asses it may reach 26 to 30 microns in length. The size, however, varies but little. It is a motile, worm-like organism, with an undulating membrane extending into a long flagellum at the anterior end. The posterior end is variable—round, tapering, or cone-shaped. The motility is not great. The structure is not well-marked in fresh specimens, but in stained ones it closely resembles that of *Tr. lewisii*. It contains large, deeply-staining granules, especially in the anterior end. The nucleus near the middle of the body is elongated and contains deeply-staining granules. The centrosome is near the posterior end, and is a round corpuscle staining more intensely than the nucleus and often surrounded by a clear zone in stained specimens. The flagellum, free in the anterior end, continues along the undulating membrane and stops near the centrosome, appearing, however, to be separated from it by the clear zone above mentioned. In involution forms flagella often appear to have direct connection.

Bruce says that this parasite as found in the dog is thicker, shorter, and the posterior end more rounded than in other animals. In the horse the dimensions are nearly double, with the posterior end tapering.

Plimmer and Bradford consider the parasite to vary in size and length with the period of the disease and the species of the animal, being the largest in the rat at the time of death.

Salmon and Stiles give as the specific diagnosis of this *Trypanosoma*:

"Twenty-five to thirty microns long, 1.5 to 2.5 microns broad. As compared with *Tr. lewisii*, the posterior extremity of *Tr. brucei* is not so sharp, the undulating membrane is broader and more plicate, the protoplasm colors more easily and more deeply, and the movements are less active. The protoplasm contains granules, which accumulate principally in the anterior half, some of which are as large as the centrosome, and they color the same as the centrosome; centrosome divides before the nucleus."

Habitat.—It is found in the blood of several species of domestic as well as wild animals. This point is more fully discussed in the chapter devoted to this subject.

Pathogenesis.—It is infectious upon inoculation for nearly all animals.

Trypanosoma rougetii; Laveran & Mesnil, 1901.

Trypanosoma equiperdum Doflein, 1901.

Rouget describes this parasite as a motile, worm-like *Trypanosoma* 18 to 26 microns long and 2 to 2.5 microns broad, with an undulating membrane and a long anterior flagellum. The posterior end is tapering or blunt and contains a small shining globule which does not stain. The protoplasm is granular. He considers it identical with other *Trypanosoma* of domestic animals.

Nocard, who worked with this parasite, considers it and the disease produced by it identical with other *Trypanosoma* and trypanosomatic infections.

Buffard and Schneider maintain a close relationship between this parasite and the others, but they are not sure of their identity.

Habitat.—Blood and lesions of horses and asses suffering from dourine.

Pathogenesis.—Naturally infected animals are horses and asses. Infection may be transferred by inoculation to dogs, rabbits, white mice, and several other animals.

Trypanosoma nepveui.

Whether or not this a distinct species is hardly determinable from the descriptions thus far given, but the work of those having cases of trypanosomiasis in man under observation will probably settle this point. All parasites of human trypanosomiasis are included tentatively in this species for convenience.

Nepveu first described a *Trypanosoma* in human blood as follows:

"This *Trypanosoma* presents all the characteristics of the genus. It has a homogeneous, colorless membrane, one border of which is thinner than the other, and hyaline, with characteristic undulating movements. This membrane bears a nucleus and a fine flagellum, situated anteriorly, the undulations of which follow in rapid succession.

* * * * *

"In conclusion, *Trypanosoma* must be classed among the parasites of human blood. I am unable at present to give a more complete description of this variety, and therefore refrain from giving it a special name. It will therefore be best first to establish the similarities and differences between this parasite and the congeneric parasites of animals and also to complete the observations on its morphology and life history."

Dutton, who has found a *Trypanosoma* in Forbe's case in South Africa, describes the parasite as follows:

"In contrasting the parasite with similar parasites in animals it approaches most nearly in its morphology *Tr. brucei*. It is the smallest of all described mammalian *Trypanosoma*; its average length is 22 microns including the flagellum; its breadth is greater in proportion to its length than in other parasites. The posterior part as measured from the micronucleus to the extreme tip is short and characteristic for this parasite.

"The micronucleus and its associated vacuoles are always large and well marked. The 'set' in fixed specimens differs from that of other species, as has already been pointed out.

"Doctor Laveran, who has very kindly examined some blood films taken from the patient, informs me that if the morphological characters are alone considered, he would regard my specimen as a new species; it differs from *Tr. brucei* in the length of the flagellum and in the small number of chromatin granules in the protoplasm.

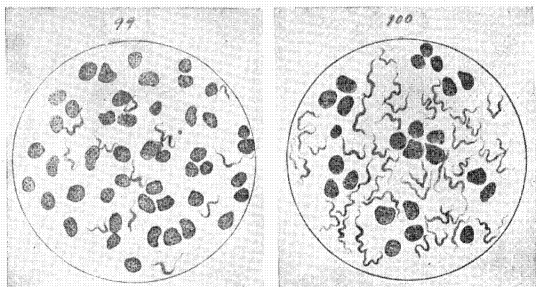
"Having as yet not had the opportunity of transferring the parasite in the blood from man to other animals, as has been so completely done in nagana by Bruce in Africa; Kanthack, Durham, and Blandford, and Plimmer and Bradford in England; Laveran and Mesnil in France; and to a less extent in surra by Evans, Steele, Lingard, Van Dyke Carter; and in dourine by Rouget, Nocard, and others, I am quite unable to contrast the pathogenicity and the morphological appearance of the human parasite in lower animals with the other species. It is to be remembered that no case has ever been recorded in man in the districts in which animal infection is so common, although man is exposed to the same risk of infection—for instance, the tsetse fly (*Glossina morsitans*, Westwood), which was proved by Bruce to carry the infection of nagana from animal to animal, bites travellers, natives and others, as well as animals.

"The consideration of these facts and the discovery of a parasite—evidently of the genus *Trypanosoma*—in the blood of a patient presenting symptoms markedly similar in very many points to those of the two or more diseases of lower animals which have been definitely proved to be caused by the presence of different species of the genus *Trypanosoma*, forces one to the conclusion that the parasite found in this patient is a new species, and is also the cause of the disease from which the patient is suffering. I would therefore suggest the name *Trypanosoma gambiense*."

Until more work has been done it is advisable to use caution in classifying this *Trypanosoma* as a separate species. It is done in this report tentatively, but the chances are that careful work will decide it to be identical with some of the others. There are several reasons for this assumption. The cases so far reported are from areas where the disease is prevalent in animals, and these cases are few in number and somewhat scattered. There are probably many cases which have not been detected, but we can not believe them sufficiently numerous to perpetuate the species without a host in some of the lower animals. It seems much more likely that there are changes in the patients which somehow interfere with their natural resistance for the well-known parasites.

Trypanosoma equinum Voges, 1901.
Trypanosoma elmassiani, 1902.

The length of this parasite, according to Voges, is two to three times and its width one-third to one-half the diameter of a red-blood cell. The anterior end is provided with a flagellum about as long as the body of the parasite, and extends backward about two-thirds the length of the body as a somewhat thickened margin of a distinct undulating membrane. The posterior end of the parasite is about one-third the length of the flagellum, and is contractile and somewhat beak-shaped. Its motion



FIGS. 99, 100.

Tr. equiperdum. 99, In the blood of a rat four days after inoculation; 100, same eight days after inoculation. (After Döflein, 1901, fig. 40.)

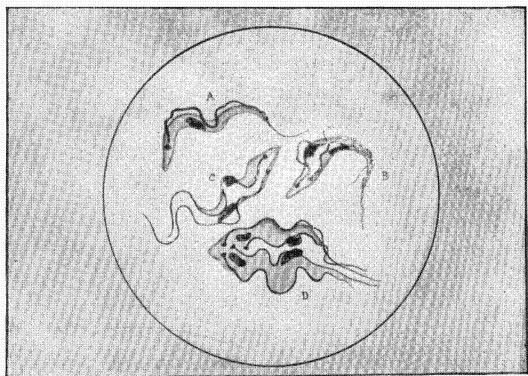


FIG. 101.

Trypanosoma of dourine in the process of evolution, clearly showing the centrosomes. Stained according to Laveran.

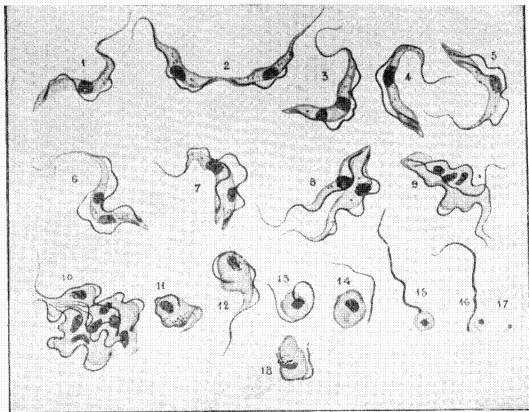


FIG. 102.

Trypanosoma of mal de cadéras without centrosomes distinguishable by staining according to Laveran or Romanowsky. (After Lignières, 1902.)

Explanation of fig. 102.

1, normal form; 2, two *Trypanosoma* united by their posterior extremities; 3, *Trypanosoma* showing the beginning of multiplication at the nucleus; 4, 5, *Trypanosoma* showing the beginning of multiplication at the flagellum; 6, *Trypanosoma* with two nuclei and two flagella; 7, division of the parasite commencing at the posterior part; 8, *Trypanosoma* commencing division at the front part; 9, *Trypanosoma* with three nuclei and three flagella; 10, large form of multiplication, very rare, with seven nuclei and seven flagella; 11, 12, 13, 14, 15, 16, 17, 18, abnormal forms of parasite.

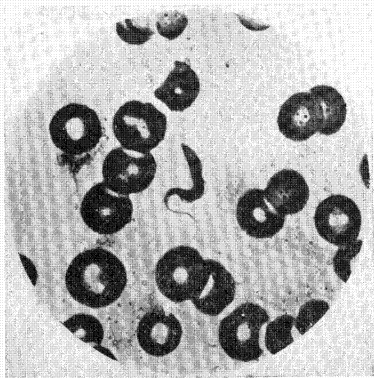


FIG. 103.

showing *Trypanosoma* found by Dutton in the blood of a European. (After Forde, in Jour. Trop. Med., Sept. 1, 1902.)

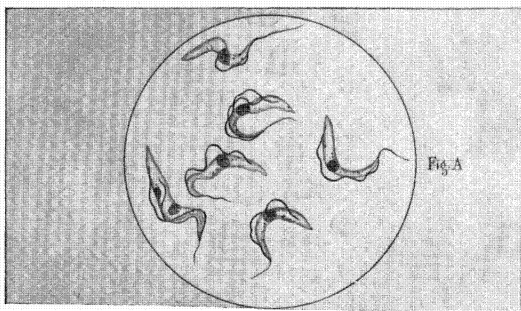


FIG. 105.—TRYPANOSOMA OF MAL DE CADERAS. STAINED ACCORDING TO LAVERAN.
(AFTER LIGNIÈRES, RECUEIL DE MÉD. VÉT., 1902, PL. II.)

resembles that of an eel, but the actual motility is not great, the whole body taking part in an excessively active wriggling motion and the flagellum and beak ends moving in opposite directions. The motion is due to the undulations of the membrane, which run in both directions. The flagellum is the anterior extremity, but the parasite may move in the opposite direction. There is a nucleus toward the anterior and a centrosome near the posterior end, and the protoplasm is granular. In young parasites (rarely found) a larger speck (nucleus) is seen near the anterior and a smaller chromatin mass near the posterior end. The chromatin mass in stained specimens is sometimes surrounded by a bright area, which in turn is surrounded by a nonstaining border.

Habitat.—Similar to that of *Tr. brucei* and *Tr. evansii*, except for cattle, which are said to be immune.

Pathogenesis.—Pathogenic for domestic and certain wild animals. Voges considers the cattle of South America immune.

Trypanosoma theileri Bruce, 1901.

Bruce has published a note regarding a new *Trypanosoma* discovered by Theiler in the cattle of South Africa. The new parasite is to be distinguished by its size, being almost twice as large as any of the others. It is pathogenic only for cattle.

Laveran and Mesnil have studied this *Trypanosoma* in specimens furnished by Theiler, and they agree that it is a new species. They give its length as 30 to 60 microns and its breadth as 2 to 4 microns. In its general structure and modes of division it does not differ materially from other *Trypanosoma*. They consider one of its diagnostic points the presence of blood cells with basophilic granules in the infected blood.

Habitat.—Blood of cattle.

Pathogenesis.—Horses, dogs, goats, sheep, deer, rabbits, guinea pigs, rats, and mice are said to be immune to this parasite, but Theiler was able to infect calves by inoculation.

Trypanosoma transvaaliense Laveran and Mesnil, 1902.

This *Trypanosoma* was discovered by Theiler in the cows of the Transvaal. Its dimensions are variable, the average being 30 microns in length by 4 to 5 microns in breadth. Its characteristic diagnosis is, according to Laveran and Mesnil, who have studied specimens submitted by Theiler, the presence of the centrosome near the center of the parasite and near and sometimes united to the nucleus. The altered corpuscle seen in blood infected with *Tr. theileri* have not been seen with this parasite.

Habitat.—Blood of Transvaal cattle.

DIFFERENTIAL DIAGNOSIS OF TRYPANOSOMA OF MAMMALS.

Regarding the differential diagnosis of the *Trypanosoma*, which are of the greatest importance in the disease of domestic animals, there seems to be considerable difference of opinion, and the work will probably not be satisfactorily completed until all the supposed varieties are studied in one country in similar environments.

According to Laveran and Mesnil the distinction between *Tr. brucei* and *Tr. lewisii* is marked. *Tr. lewisii* is thinner and more tapering, and its undulating membrane is smaller and less folded. Its protoplasm colors less deeply. Its chromatin granules are not so large or numerous. Its posterior extremity is always thin and tapering and never has the appearance of a truncated cone. It lives longer on ice than does *Tr. brucei*. However, individuals showing no material differences are found in both varieties. In fresh blood without the presence of dividing forms they are differentiated with great difficulty. In *Tr. brucei* the centrosome always divides first, following which the flagellum, nucleus, and protoplasm separate in the order named. In *Tr. lewisii* division may begin in the nucleus, and before it takes place the parasite sometimes reaches 5 microns or more in breadth.

Tr. equiperdum, according to the same authors, closely resembles *Tr. brucei*, but the morphologic differences between the two are appreciable. *Tr. brucei* has much greater dimensions; its protoplasm colors more deeply and nearly always contains large chromatin granules, which are absent in *Tr. equiperdum*, which is never more than 20 microns in length. However, we have, in the blood of animals, seen *Tr. equiperdum*, which closely resembled *Tr. brucei*, that methods of differential diagnosis were unsatisfactory.

Tr. brucei and *Tr. equinum*, according to Laveran and Mesnil, have almost the same length and form. The protoplasm, the nucleus, the undulating membrane, and the flagellum have the greatest resemblance in the two *Trypanosoma*, but this is not true

of the centrosomes. The centrosome of *Tr. brucei* colors easily and deeply and measures about $1\frac{1}{2}$ microns in diameter; that of *Tr. equinum* does not measure more than one-third or one-fourth micron, and colors rose like the flagellum, and not violet like the centrosome of *Tr. brucei*. A number of chromatin granules difficult to examine are often found near it. Some observers have come to the conclusion that the centrosome is defective in *Tr. equinum*. Owing to the fact that the centrosomes differ in stained specimens of the blood of mice infected simultaneously with *Tr. brucei* and *Tr. equinum*, they have been able to distinguish the two species of *Trypanosoma*. The forms of multiplication are the same, double partition being the rule. Large divisions into three or four parts, which are somewhat more common in *Tr. equinum* than in *Tr. brucei*, are sometimes observed.

Martini considers the posterior end of *Tr. brucei* more blunt than that of *Tr. lewisii*, *Tr. equinum*, or *Tr. evansii*.

Buffard and Schneider and several others believe *Tr. rougetii* to be identical with the other *Trypanosoma* producing Trypanosomiasis in domestic animals.

Scheube, Bruce, Rost, Koch, and many others consider *Tr. evansii*, *Tr. brucei*, and some of the other parasites identical.

Lignières has recently written elaborately regarding the distinctions between the various *Trypanosoma* of mammals. In the main his results agree with those of Laveran and Mesnil already given, and his additional conclusions are, in some instances, based upon his misconception of the work of others.

A consideration of this subject resolves itself into two headings—first, a differentiation based upon microscopic observations of the parasites, and second, that based upon their pathogenic action. As might be expected, the more two parasites differ when compared by one of these methods the greater will be the difference between the two as determined by the other.

Tr. lewisii differs morphologically from the parasite of nagana, surra, etc., and these differences are confirmed by those in their pathogenic action. Concurrence of opinion on the individuality of *Tr. lewisii* as found in different countries is so universal that further attention need not be paid to it.

When we come to consider the identity or nonidentity of *Tr. evansii*, *Tr. brucei*, *Tr. rougetii* (*equiperdum*), and *Tr. elmassianii* (*equinum*), we are compelled to obtain our data for all of these parasites, except *Tr. evansii*, from the work of other authors.

Taking up first the study of morphologic differences, we fail to see any justification for the extremely careful and guarded conclusions of Laveran and Mesnil, or the very sweeping ones of several more recent authors. They have disregarded the fact of the variability of these organisms in the same species of animal in the same country, their greater variability in different species of animals in the same and in different countries, and other conditions requisite to identity of environment and to a conclusive comparative study. It must be remembered that we are dealing with organized animal life and that environment has an important influence on its physical condition.

The most important differences which conservative writers generally point out between these organisms are variations in the shape of the posterior extremity, the centrosome and the undulating membrane, and the granular condition of the parasite itself.

From careful observations we are confident that the posterior end of *Tr. evansii* is contractile, a condition which a few writers have noted in other parasites. This results in a variation of the shape of this extremity in *Tr. evansii*, and doubtlessly in other parasites, as great as that given for any two members of the group.

The same statement applies to some of the other supposed differences, such as variations in the undulating membrane and the general morphology of the parasite.

Another important factor which has not been given due consideration is the age of the parasite, as is also the condition, with reference to life, of the media from which the preparations are taken for study. In *Tr. evansii* and probably in some of the other parasites the number and size and to a certain extent the location of the granules depend upon the conditions mentioned. The difference in the staining of the centrosome in *Tr. brucei* and *Tr. elmassianii* (*equumma*), first emphasized by Laveran and Mesnil, we are not in a position to comment upon.

Laveran and Mesnil have written very carefully regarding the differentiation of these parasites, and are most conservative in considering differences in pathogenic action, regarding the latter as secondary in importance to the morphologic differences of the organisms. More effusive and less careful writers have drawn emphatic conclusions from pathogenic manifestations alone. There is undoubtedly a great similarity in the pathogenic action of the various *Trypanosoma*, in general the same animals being susceptible and showing similar symptoms and post-mortem lesions. The chief differences are those of degree, and they vary almost as much in different

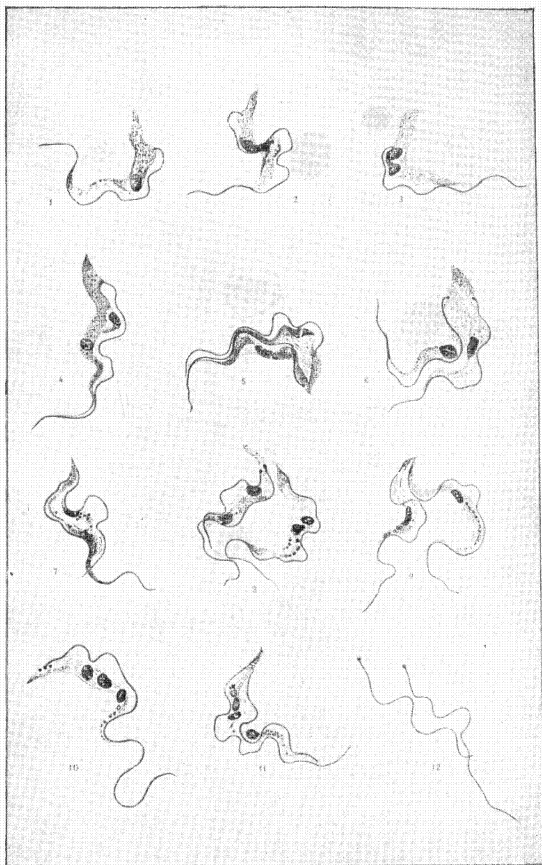


FIG. 104.

Tr. equinum. 1-6, Forms of multiplication in the blood of a horse; 7-9, same in the blood of a guinea pig; 10-11, polynuclear forms in the blood of a guinea pig in a state of gestation; 12, flagella and centrosomes free in a preparation made from the blood of a guinea pig in a state of gestation. (After Sivori and Lecler, 1902, Pl. IV.)

animals of the same species when inoculated with the same *Trypanosoma* as with different *Trypanosoma*. Cattle, for example, have been used to show differences in the parasites, when as a matter of fact in Manila these animals, when inoculated with *Tr. evansii*, show variations as great as those noted in literature for any two diseases.

After carefully reviewing literature and taking our own observations into account, we do not feel justified in forming a positive conclusion; but it seems to us that proof sufficient to establish the individuality of the *Trypanosoma* causing trypanosomiasis in domestic animals has not yet been advanced.

MODES OF TRANSMISSION AND INFECTION.

Believing as we do that the transmission of *Trypanosoma* by biting and stinging insects is the only method deserving consideration from a practical standpoint, we are in harmony with the best thought of modern literature on the subject. To demonstrate that this is the only practical method requires (1) evidence of a host constantly present in infected zones, (2) direct evidence of transmission from this host to the healthy animal, and (3) evidence that in the absence of either the host or the insects the disease is not communicated.

With reference to the presence of the host, we have ample evidence that it is constantly present in the different countries afflicted with *Trypanosoma*. It has been shown that in Africa elephants, camels, cattle, and other animals live for months and sometimes years with this disease, certainly long enough to carry the source of infection from one rainy season to another. Foá, Bruce, and others in this same country have shown conclusively that a certain percentage of the wild animals are infected and that they harbor the parasites with little or no inconvenience to themselves. They have further shown that when these animals are driven from a community, the biting flies to a large extent follow them, and in this manner the epidemic which may be raging at the time is almost completely suppressed. In India, camels, cattle, and other animals live long enough with this infection to carry the disease from one season to another; in fact the camel may live for more than three years. Rogers and others believe that in India the cattle, which live for months with *Trypanosoma* in the blood and often completely recover, principally act as the hosts. In South America wild animals and certain species of cattle when infected live for a considerable time and act as hosts in the propagation of the disease. Some of the recent writers in that country have concluded that horses are infected in sufficient numbers to act as hosts.

In the Philippine Islands with an epidemic of two years' duration it has been found unnecessary to go outside of the horse family to find a host constantly present. In Manila infected horses are found during the entire year, during the dry season, of course, in small numbers. The wild animals of this country have not been examined, and cattle, while susceptible to the infection, are rarely found to be naturally infected.

In literature there is an abundance of incontrovertible evidence to prove the disease to be transmitted from sick to healthy animals by biting insects, and this has been fully confirmed by our work, as will be seen below. There is also sufficient evidence to show that in the absence of either the host or the biting insects, the disease does not spread.

By contagion.—There is nothing in the nature of the disease or in the manner of its spread that in the slightest degree indicates transmission by contagion. The same may be said also of congenital transmission. Observers are unanimous in the opinion that the fetus in utero is not infected. We have performed a number of experiments in this line on dogs, monkeys, rabbits, guinea pigs, and rats. In one dog infected with *Trypanosoma* by inoculation about two weeks before delivery, miscarriage followed on the eighth day. In none of our other animals was gestation interfered with and the young were never found to be infected, though susceptible to infection. In one of our experiments two puppies were allowed to nurse from an infected mother in an insect-proof stable, and at the time of the death of their mother, eight days after their birth, they were free from infection.

By coition.—Almost all writers, referring to dourine, state that it is transmitted by coition, and a considerable number believe this to be the only method of transmission for this disease, while others believe it to be the exception even in this form of trypanosomiasis. This method of transmission has been given little consideration in relation to the other forms.

Recently some writers upon this subject have offered at least suggestive explanations. Schilling believes that transmission by coition occurs in those regions free from the usual infecting insects and from other conditions favorable to the propagation of the disease; and the geographic distribution of dourine would tend to sup-

port Schilling's conclusions. In infected countries, if the infection takes place by coition, it is lost sight of in the more frequent methods and could be determined only by careful experimentation.

We have performed a number of experiments looking to the elucidation of this point in the epidemic now raging in this country. Considerable difficulty has been experienced in obtaining direct evidence. Horses are not available for the work, and with the native ponies it has been almost impossible to find at the same time infected animals and those desiring intercourse. In several instances infected blood has been introduced into the vagina of female dogs by the use of a catheter. All these experiments except one have given negative results, and in the positive one infection is attributed to a lesion of the vagina. In those cases in which the mucous membrane of the vagina was injured purposely, infection following the introduction of virulent blood occurred in every case, with an incubation period equal to that following infection through the injured mucosa of the mouth.

We have not observed an absolutely conclusive result following coition. One male dog contracted the disease after intercourse with an infected female; but a small number of biting and stinging insects were present at the same time, so that it was probably transmitted by them. Upon another occasion an infected male goat was seen to copulate with a healthy female, but no infection followed. This was hardly the most desirable kind of an experiment, since the goat in question rarely showed parasites by microscopic examination, though his blood was infectious by animal experiment. Again, the manner in which goats effect copulation would be much less likely to result in infection than in the case of the horse, provided, as has been suggested, it depend upon traumatism. It seems more than probable, however, that in many animals, and especially in the case of the horse, infection might often follow sexual intercourse as the result of traumatic injury of the genitals. It is not uncommon to see a few drops of blood after sexual intercourse between these animals, and it would certainly require no stretch of the imagination to suggest the possible presence of small injuries in the mucosa of the genitals of both animals. It does not appear, however, that much importance should be given to this as a practical means of transmission of the disease. Any disease of horses transmitted only by coition could, of course, be eradicated with the greatest ease.

Rats as carriers of the infection.—In referring to the part played by rats we come to a much more important subject. To bring out its full significance necessitates a brief consideration of the natural infection of rats with *Tr. evansii*, a point which will be thoroughly discussed under "Trypanosomiasis of rats," and a consideration of the bearing such infection has upon the transmission of surra in animals of economic importance.

Rats, in an indefinite way, have been blamed for the transmission of the disease. Lingard has made elaborate experiments to show that grain soiled with the excrement of these little pests and eaten by horses plays an important part in the spread of the infection. He has demonstrated that rat surra is transferable to horses by inoculation; but, owing to his failure properly to protect his animals from insects, his work has received but little consideration. Musgrave and Williamson have shown conclusively that a certain percentage of rats in Manila harbor *Tr. evansii*.

In a preliminary report they say:

"A varying percentage of rats are known to harbor a *Trypanosoma* somewhat resembling the one found in the horse, and it has been conclusively shown that a certain number of rats in Manila harbor the same *Trypanosoma* which causes the disease in other animals. These parasites have been determined both morphologically and in their pathogenic action to be identical with the parasite causing trypanosomiasis in horses."

With this information we are prepared to consider the part they play in transmitting the disease to domestic animals and in perpetuating the epidemic. Rats frequently fight, and it has been shown that the infection passes from one to another in this way. In addition, the wounds so caused attract biting insects, particularly fleas, which are known to transmit *Trypanosoma* from rat to rat, and as will be seen later, from rats to other animals. In Manila the number of rats infected with *Tr. evansii* makes it necessary seriously to consider them in discussing means of controlling the disease in this city.

Infection of pastures, food, and water.—Infection through the sound mucosa and through the injured mucous membranes presupposes to a large extent as its source infected food and drink. Lingard, the great champion of this method of transmission, considers the ingestion of stagnant water and of grass from land subject to inundation a source of infection, the latter being a favorable breeding place for low forms of animal life and possibly of *Trypanosoma*.

Salmon and Stiles believe that there is nothing at present known in connection with the life history of any *Trypanosoma* to lead us to look seriously upon grass as a

source of infection. We know that *Trypanosoma* die very rapidly under all usual conditions outside of the living body. If they are to be found in either food or drink, they must be in some phase of the life cycle with which we are unacquainted. If food and water should be infected, as Lingard maintains, they would still be harmless in the presence of the demonstrated fact that the disease is not transmittable through the sound mucosa of the alimentary canal.

In a preliminary report Musgrave and Williamson make the following statement regarding this subject:

"The existence of an extra-corporeal stage of *Trypanosoma*, living on grass and in water in marshy places, in this stage taken into the stomach of susceptible animals eating and drinking in these localities, and from this organ or other part of the animal economy passing into the blood in the forms we recognize, is without sufficient evidence to warrant consideration in this paper.

"Before leaving this subject, however, for a fuller discussion in a subsequent paper, it is proper to state that *Trypanosoma* quickly die under all tried environments outside of the body of some living creature, and no evidence of their existence in water, on grass, or other similar places can be advanced. Both water and grass have been inoculated with large numbers of *Trypanosoma* and have failed to convey the disease, after days, weeks, or months, when fed to susceptible animals, and also when injected under the skin.

"Malaria is similar to trypanosomiasis in that both are parasitic diseases and both are prevalent in low-lying, marshy lands and during wet weather. Malaria was for ages attributed to the air, the water, etc., of these marshes, and it took years to make the public understand that all these conditions are harmless in producing it, provided the patient is protected from the bite of mosquitos, so prevalent in these regions.

"Take the epidemic of trypanosomiasis in Manila. At the time of its outbreak and for some time afterwards, it was confined to the city. The grass and water given the horses were the same which had been fed for years, and no disease resulted.

"The disease started from a focus of inspection and spread directly with exposure to infected animals, and attacked alike animals fed exclusively on hay and oats and those fed on grass. The disease is prevalent in Manila at the present time and has been so continuously since its introduction. The majority of horses having the disease, under our observation for the past four months, had been fed previously entirely on hay and oats.

"In one large stable, with both American and native horses, four of the American horses and mules (fed entirely on dry feed) and two of the native ponies have died of the disease, and one of the two ponies was the only horse of this class in the stable which received dry feed only.

"The statement is made that certain districts in India are avoided by cavalry on the march because of the danger in these districts from food and drink through which animals may contract the disease. Similar conditions are found in South America, but in addition it has been shown that infected districts on this continent are just as dangerous to horses provided with dry food and pure water while passing through them as they are to animals eating forage grown on the spot.

"It has been shown by a number of observers that an infected animal taken to a new place becomes a focus for the spread of the disease, provided biting flies are present, no matter whether the territory is marshy or dry."

Since that time the work has been continued, but no evidence has been obtained to show that food, water, or pastures are ever factors in the spread of the disease.

Attempts artificially to infect water and grass have always failed. It is true that when these substances are used as culture media parasites may live for a short time under certain conditions, but multiplication to an appreciable extent does not occur. It is, of course, possible that infection may occasionally take place in localities where sick and healthy horses graze on the same ground or drink water from the same place, provided both classes of animals have lesions of the mucous membranes or cutaneous wounds on those parts of the legs which come in contact with the grass or the water. It is absolutely certain, however, that if food and water are ever infected to any degree it must be with some form of the parasite not yet known. Even if such places served as culture media for *Trypanosoma*, as we know them, they would still be comparatively harmless to those animals having sound mucous membranes and free from cutaneous wounds.

Infection through the sound mucosa.—There is some difference of opinion, especially among recent writers, in regard to infection by food and drink through the sound mucosa of the alimentary canal. Lingard affirms emphatically that the disease is so transmitted, but the great majority of recent investigators state with equal positiveness that the disease can not be so produced.

Kanthack, Durham, and Blandford attempted to transmit *Trypanosoma* by feeding, performing a number of experiments. At times they were successful, but in most

cases they failed. They concluded that the possibility of infection depends upon accidental lesions of the mucous membranes of the upper portion of the alimentary canal. Continuing they say:

"Of a number of rats fed on the organs of nagana animals only a few acquired the disease, and these invariably showed superficial lesions of the snout and ears, due to lice. When fed upon infected material, they buried their snouts in it and scratched their ears with their blood-stained forepaws. Furthermore, in rats which acquired the disease through feeding, the cervical glands were always enlarged most, a fact which proves that hematzoal infection must have taken place in the head, for, as we shall show, the primary infection travels by the lymphatics.

"A cat fed repeatedly on the soft tissues of bodies of infected dogs and cats, and subsequently on the bodies of dead rats, died at a time corresponding by lethal period to an infection at the first meal on rats. We regard it as probable that some splinter of bone caused a superficial lesion, through which the hematzoa were enabled to enter.

"A rabbit fed carefully by means of a pipette with large quantities of infected blood did not show the slightest sign of the disease. Rouget (1896) also failed to infect animals by the mouth."

Evans and Steel believe that surra can be transmitted either by ingestion or by inoculation in dogs, horses, and mules, provided that fresh infected blood is used. With blood kept twenty-four hours or more they did not succeed in conveying the disease.

Writing in 1899, Lingard considered that natural infection with surra might occur in one of four ways: (1) From eating grass and other vegetation grown upon land subject to inundation; (2) from drinking stagnant water during certain months of the year; (3) from the bite of certain species of flies, probably as carriers of the virus; and (4) from the ingestion of corn soiled with the excrement of rats and bandicoots.

Having determined that the *Trypanosoma* of rats in India was the cause of trypanosomiasis in a certain percentage of other animals, such as the horse, he experimented to prove whether this was of any practical importance in the spread of the disease. He mixed the excreta of rats with grain, which was fed to horses during the dry season in an area free from surra, with negative results. With similar experiments, however, under favorable conditions of moisture and heat he claims to have obtained positive ones. With regard to these, he writes as follows:

"At a later date, during the latter half of the hot season and the rains of 1893, further experiments with the same end in view were carried out in Bombay, where the climate is favorable from its humidity and the disease is enzootic. From these positive results were obtained, the incubation period occupying four months (about June to September), but the incubation period of the disease will probably be found to vary with the amount of moisture in the atmosphere and the amount of materies morbi ingested by the animal. This points to the probability that a number of surra cases in Bombay were contracted through the ingestion of rats or bandicoots' excreta mixed with the corn."

Salmon and Stiles doubt the accuracy of these results. They say that *Trypanosoma* have not been found in the excrement of either horses or rats; that it is not clear that Lingard used the necessary precautions to exclude fly bites and other factors in his experiments, and that if rats harbored *Tr. evansii*, transmission from them would have been as possible by rats' fleas as by their excrement. Voges fed animals with several liters of infected blood mixed into a paste without results. Laveran and Mesnil also failed to convey the disease through the sound mucosa. Rouget's feeding experiments were negative, but he obtained positive results by dropping infected blood into the conjunctiva. Rogers was unable to convey the disease through the sound mucosa, and says that in those cases in which infection occurred by feeding there were injuries of the mucous membranes. Rost writes that grass, grain infected by rat's excreta and flies must be considered in the etiology. Salmon and Stiles consider ingestion as a possible means of infection, but state that it can deserve no special consideration as a means of transferring the disease from horse to horse.

It appears to us that one of the strongest arguments against the transmission of the disease through food and drink is furnished by Lingard himself. He states that a street car company, which had lost hundreds of horses from surra, finally provided their animals with boiled drinking water only, and with grass brought from an elevation of 6,000 feet, prohibited the feeding of green vegetables, and also ordered the animals to be isolated, without success. It is to be noted that these stables were situated on a street along which infected horses were traveling, so that the isolation of the company's animals did not protect the healthy ones from flies. The manner of feeding did exclude infection by this means, and seems to us a strong point in determining that food and drink play absolutely no part in the transmission of the disease.

The numerous citations of instances in which dogs contracted trypanosomiasis by eating the carcasses of animals dead of the disease seem to us to be no argument in favor of its transmission through the sound mucosa. Such animals are always fighting, and the infection might readily take place through wounds, and in addition these animals are usually well provided with biting insects. Curry states that it is not known whether the disease in the Philippines can be transmitted by food and drink.

Our investigations have failed to produce the slightest evidence that infection by food, drink, or otherwise ever occurs through the sound mucosa. Musgrave and Williamson, discussing this mode of transmission, say:

"The great majority of writers agree that infection can not take place through the sound mucosa of the alimentary tract, and that the occasional infection following the administration by mouth of the virulent blood and organs of animals recently dead of the disease are probably due to the fact that these animals had damaged mucous membranes of the mouth or upper part of the alimentary canal, which would, of course, result in infection, just as would occur in any other part of the body by bringing an injured surface into contact with infectious material, or vice versa.

"In nearly all feeding experiments large doses of the infective agent have been given, and in this sense they have not approached natural infection, which, from the nature of things and whether administered through the mucous membrane or the skin, would be in small doses.

"Lingard attempted infection through the digestive canal by the administration of very small doses of infected blood, given frequently in large dilutions of water. One of his horses that had received such treatment, and in addition one dose of 13 c. c. of infected blood, developed the disease on the one hundred and thirtieth day after the beginning of the experiment. He fed a second horse 200 minims of fresh virulent blood at one dose, with an incubation period of seventy-five days. He does not state that these horses were protected from insects during the periods of the experiments, which were made in an infected country, and it is more than probable, considering the incubation periods of one hundred and thirty and seventy-five days, that his animals were infected in some other way.

"So far as we have been able to discover, there is not in literature any absolute proof of infection through the sound mucosa by feeding.

"In this preliminary report but one of our many feeding experiments will be given.

"Monkey No. 126—healthy adult male monkey—was isolated, temperature taken, and blood examined daily for a week. The temperature remained normal and the blood negative for *Trypanosoma*. After twelve hours' fasting, he was fed weekly for six weeks on cooked rice (the usual diet) soaked with fresh, warm, virulent blood, rich in *Trypanosoma*, from different animals at different feedings. On two occasions he was given to drink infected blood in weak potassium citrate solution, in which *Trypanosoma* live longer than in any other known solution outside of the body.

"At the end of six weeks the animal was apparently in good health, temperature had remained normal, and the blood free from parasites. In order absolutely to exclude the existence of infection, a drop of blood was injected subcutaneously into another monkey, which remained well and was afterwards proved susceptible. During the feeding the infected rice would often be stored in his chops and remain there for hours.

"After proving the animal not infected at the end of six weeks, a small scratch was made in the mucosa of the mouth and he was again fed as before. The disease developed on the fourth day, as was evidenced by rise in temperature and the presence of *Trypanosoma* in the blood. He ran the regular course of the disease, and died on the eighteenth day after infection."

This work has now been continued for more than a year, involving the use of hundreds of animals. We have experimented with horses, dogs, goats, rabbits, guinea pigs, monkeys, cats, and rats. We have fed them large and small doses of virulent blood and all kinds of preparations of both blood and infected organs. All experiments were performed under circumstances which made accidental infection impossible. Particular attention to this part of the subject was deemed necessary in order intelligently to recommend measures for the control of the epidemic. Our results have given absolutely convincing proof that infection does not occur through the sound mucous membranes by *Trypanosoma*, no matter in what form administered.

Infection through the injured mucous membranes.—As stated by Musgrave and Williamson in a preliminary report, surra is essentially a wound disease, and transmission through the injured mucous membranes results when infected material is brought in contact with it. When infection occurs through the alimentary tract it

does so through a wounded mucous membrane. Monkey No. 126 was one of the many animals experimented upon to determine this point, as well as the possibility of transmission through the sound mucosa. Of course it was easy to prove that infection could occur through an injured mucous surface, but definitely to show of what importance this would be in the practical transmission of trypanosomiasis required more work.

It was necessary, first, to determine what percentage of a number of animals in the natural course of events have sufficient injuries to make possible an infection in a given period of time. Naturally this was found to vary greatly. In dogs and rats injuries are so frequent that in order to obtain animals without lesions to be used in determining the possibility of transmission through the sound mucosa we were compelled to confine each animal by itself for some time. In horses, cattle, and other animals of economic importance natural lesions of the mucous membranes are very rarely found. In horses used for carriage and draft purposes lesions in the corner of the mouth, caused by the bridle bit, are quite frequent. In the case of cattle and carabao lesions are seen in the nose around the ring which is placed through the septum and which usually has a rope fastened to it. Small wounds might occasionally be produced in the mouth by eating rough, dry food.

With injuries present in the mucous membranes, the next question to consider was the manner in which infectious material may be brought in contact with these wounds; and from a practical standpoint (excluding flies) there are not many possibilities. All such means are of course mechanical, and readily suggest themselves. They are: Changing bridle bits from sick animals to healthy ones, allowing healthy animals to lick sores on sick ones, placing animals to graze upon the same ground or allowing them to drink the same water, etc.

Here may be introduced a strong argument against the theory that food and water play a serious part in the transmission of the disease. If such were the case, animals with wounds would contract the disease from eating and drinking food and water which had been allowed to stand just as readily as they do when freshly infected material is fed to them, but this is not the case. We have experimented on animals with fresh wounds, feeding them water and grass infected from forty-eight hours to three months previously, and kept under all kinds of conditions, but have failed to convey the disease in this manner.

Flies.—Of the biting insects that play a part in the transmission of the disease, certain varieties of flies are of the greatest significance.

Of flies credited with playing an etiologic rôle in this disease, the tsetse fly (*Glossina morsitans*) is among the most important.^a

Schilling states that *Glossina logipalpis* is very prevalent in Togo, as well as *Stomoxys calcitrans* and three species of *Tabani*. He regards all these varieties as able to transmit the infection. He proved conclusively that at least two species of these flies can transfer the infection in dogs.

Martini found normal *Trypanosoma* twenty-three hours after feeding the *Stomoxys calcitrans* on infected blood, the insect itself being kept in a room at a temperature of 23° C.; but he did not see dividing forms. On the following day the blood was digested and the parasites could not be observed. On dogs, biting experiments with these flies failed. Healthy horses and asses standing next to sick horses, all covered with *Stomoxys calcitrans*, did not contract the disease. Martini's work was performed in Berlin.

Working in Manila, Curry considered the *Stomoxys calcitrans* as the principal agent of transmission and found enormous numbers of them feeding on sick animals. He observed active *Trypanosoma* in the proboscides and stomachs of these flies twenty-four hours after their feeding upon infected blood. He was unable to find *Trypanosoma* in any other species of flies. Rost found *Trypanosoma* in juices squeezed from the horsefly some hours after feeding on a surra animal, and he was convinced that these transmit the disease.

Lingard describes an epidemic in India in which flies were very numerous and no precautions to isolate or destroy infected ponies were taken. Sixty-five animals died in the region in question. During the next season, however, in the same locality and among the same class of horses, the infected animals were isolated and only two deaths occurred. He demonstrated that the body fluids of certain flies contain

^a We had hoped to introduce here a short illustrated description of each species of flies, which have been credited with playing a rôle in the transmission of *Trypanosoma*, but the pressure of other work has prevented the entomologist, to whom the duty was assigned, from completing the undertaking. At some future time we hope to be able to do this, when we shall also finish the discussion of some of the points left open in this paper.

Trypanosoma after feeding on infected animals and that the inoculation of such fluids in susceptible animals causes the disease. He and his assistants examined large numbers of *Diptera* of some ten varieties, during both the dry and the wet season, but *Trypanosoma* were not found in any case, except in adult flies which had fed on infected animals.

Sivori and Lecler in South America proved that the *Musca brava*, the *Stomoxys calcitrans*, and the *Taon* can transmit the disease from horse to horse. The relative of these flies, *Ochlerotatus obifasciatus*, also showed *Trypanosoma* after feeding on a sick horse, but did not prove capable of transmitting the infection.

Voges states that the disease is transmitted only through wounds, injections, etc. Several varieties of *Tabani* are found in South America, and the *Musca brava* is also prevalent, as well as various kinds of mosquitoes.

Wasielewski and Senn consider *Tabani* as active factors in the transmission of the disease.

Rogers proved conclusively that surra is transmitted by flies which have recently bitten infected animals. Infected flies kept from one to four days did not transmit the disease by biting, and were harmless when fed to rats.

Bruce considers the tsetse fly able to convey the disease for forty-eight hours after feeding on infected blood. He placed five muzzled horses in areas containing flies, and notwithstanding the fact that they were all prevented from using the food and water found there they contracted the disease. Suspected flies transferred to a district free from nagana conveyed trypanosomiasis by biting two dogs after four to seven hours. He found living *Trypanosoma* in the proboscides of these insects forty-six hours after they had fed on infected blood, and in their stomachs one hundred and eighteen hours after feeding; but at the end of one hundred and forty hours no parasites were present.

Schilling noticed that at a certain place in Africa on one side of a lagoon 3 kilometers in width surra and tsetse flies were prevalent, while on the other side neither could be found.

Without going into further detail there is abundance of incontrovertible evidence that the disease is transmitted by a number of species of biting flies, as was the opinion of the natives of India and Africa long before science demonstrated the fact. It has thus far been conclusively shown that the tsetse fly (*Glossina morsitans*), at least one other variety of *Glossina*, *Stomoxys calcitrans*, *Musca brava*, *Taon*, and at least one variety of *Tabani* transmit the disease. All other biting insects have been looked upon with suspicion, but absolute proof of transmission by them has not been furnished.

Is it a mechanical action or is it one phase of the life cycle of the parasite which takes place in these insects? The time limit of infection in all conclusive experiments has been too small to admit of any other construction than that the action is mechanical. This is the conclusion of nearly all modern writers. Schat, whose work has been mentioned above, is the only exception, but his experiments do not confirm his theory that a phase of the life cycle of the parasite takes place in the fly. The time limit of infection for these insects is given by most authors at twenty-four hours, and a few place it as high as forty-eight. Agreeing with Salmon and Stiles, we must say that a phase of the life cycle in insects is certainly not necessary to a definite continuation of the infection, and it is extremely doubtful that it exists.

We have transferred the infection to monkeys by biting flies in experiments so guarded as to make the results absolutely conclusive. We have also transmitted it by means of the common house fly from an infected dog having a wound to a healthy one in a similar condition. Monkeys are difficult to experiment with, for the reason that they take pleasure in destroying all flies coming near them, but we succeeded in performing our experiments by placing one of the animal's legs in a test tube containing flies which had recently been fed on infected blood. These experiments have been repeated, and the transmission of the disease to the horse, dog, monkey, rat, and guinea pig by biting flies has been confirmed. Our work has been conducted with the greatest care and in all cases controlled by animal experiment. In short, the transmission of the infection in this way has been so frequently shown that further demonstration hardly appears necessary.

With these facts before us, however, we have yet to discuss the very important part of the subject which refers to the rôle which these insects play in the practical dissemination of the disease. This, of course, is difficult to prove by direct experiment without great expense and trouble, but the evidence showing this to be the usual method of transmission is so conclusive as to render such experiments unnecessary.

Summarized, this evidence is as follows: It has been repeatedly shown that biting flies can transmit the infection. It has been proved that animals protected from insects do not contract the disease, but that when protected from every other source

of infection but this one trypanosomiasis occurs with the usual regularity. Finally, no other suspected method of transmission explains why they are found in zones where the disease is epidemic.

Fleas.—Plimmer and Bradford and Rabinowitch and Kempner have shown conclusively that fleas may transmit *Tr. lewisi* from rat to rat; and it has been suspected that they may play a similar rôle in the more important animals, although this suspicion had not, at the time this work was taken up, been demonstrated.

With reference to the transmission of the disease by fleas, our own work has been absolutely convincing. Surra has been transferred by these insects from dog to dog, from rat to rat, and from rat to dog. Horses have not been used for this work because of their cost and the apparent uselessness of wasting expensive animals without material gain in information.

Sources of error in this work were eliminated in the following manner: The dogs were placed in an area covered with sand and protected from insects by screens. All but one of the dogs were then taken from the stable, and this one we proved to be free from *Trypanosoma* by animal experiment. A surra-infected dog was then placed near by but separated from the other one by a screen to prevent them from touching each other, but at the same time allowing free passage to the fleas. The healthy dog developed the disease on the sixth day, as evidenced by a rise of temperature and the presence of parasites in the blood. This experiment was repeated a number of times with positive results. The time intervening between the admission of a dog and the first positive evidence of disease (as nearly as the incubation period could be estimated) varied from five and one-half to twelve days.

All animals were then removed from the flea-infected area and only healthy ones introduced after periods of time varying from twenty-four hours to four weeks. Although the fleas in the sand remained quite plentiful no infection occurred.

Rats in screened cages placed in this flea-infected area in close proximity to an infected dog contracted the disease. The dog was then removed and a cage of healthy rats substituted, some of which contracted the disease.

These observations have removed fleas from the doubtful means of transmission and proved them to be a factor to be carefully considered in our efforts at prevention. Fleas are very numerous in Manila, especially so during the wet season, when trypanosomiasis is most prevalent.

Mosquitoes.—Beyond the bare mention of the possibility that these insects may transmit *Trypanosoma*, we have been unable to find any records in literature, and because of the lack of time our experiments in this direction have not been as thorough as we desired.

A number of experiments have been performed, all of which have been negative, and were carried out with young monkeys and guinea pigs in the following manner: A young guinea pig with parasites in its blood and a healthy one were placed in a large mosquito-proof cage and separated from each other by a coarse wire screen. Mosquitoes were then placed in the cage in large numbers, and more were added when necessary. The experiment was continued for a month without results.

Mosquitoes were allowed to feed upon infected blood and then placed in a large test tube, into which a monkey's arm was introduced and allowed to remain for three hours at a time. The experiment was repeated daily for a week, but no infection occurred.

The mosquitoes used in these experiments were *Anaphales*, *Stigomyia*, and *Culex*. These varieties are all very prevalent in Manila, but do not appear to disturb domestic animals greatly; and for that reason, even if they sometimes carry the infection, as is likely, they deserve only secondary consideration in discussing the spread of surra in horses. It is more than likely that the large gnats found in swampy places and which attack large animals are important factors in the transmission of trypanosomiasis.

Lice.—These little pests are repeatedly mentioned in literature as possible agents in the transmission of the different forms of trypanosomiasis, but, so far as we have been able to determine, there is no direct evidence furnished that such is the case. It certainly appears possible that the disease may be transmitted by lice, especially in the case of animals, such as rats and other small animals, suffering from wounds; but, as far as the larger ones are concerned, we can hardly consider these insects as a practical means of dissemination for the disease. We have repeatedly performed experiments on monkeys, dogs, and guinea pigs in order to determine this point, but so far they have failed to give positive results; nor have we been able to find *Trypanosoma* in lice caught on the bodies of infected animals.

It has already been pointed out that lice are very numerous on rats and help to cause small wounds on these animals, especially around the ears. They are also exceedingly numerous on carabaos, but do not appear to produce any injury to these thick-skinned animals.

Ticks.—As in the case of lice, ticks have been blamed by a number of writers as agents in the transmission of the disease. Voges does not believe they play an important rôle, for the reason that a tick no sooner injures the skin than it absorbs the blood of the surrounding tissue by suction, and as soon as this is accomplished falls to the ground. The feedings of the tick are so far apart that *Trypanosoma* would not likely be carried by them from one animal to another. This logic seems to us to be very satisfactory and has been accepted without experiment.

Enormous numbers of ticks are present in certain sections of the Philippines, and if they were agents in the spread of the disease they would merit very careful consideration.

Infection through open skin wounds.—From what has already been said in discussing infection through the injured mucosa, it will readily be seen that skin wounds are a constant source of danger during the prevalence of the disease. Such places entice flies, which can undoubtedly infect wounds with greater ease and certainty than they can uninjured skin surfaces. With the presence of skin lesions there are many additional possibilities to be considered, which may be disregarded in dealing with sound animals. These may vary somewhat with environment, but in no case are they of frequent occurrence. Musgrave and Williamson mention among these agencies the passing of currycombs, brushes, etc., over wounds on sick animals and then over similar places on healthy ones.

With a fuller understanding of rat infection a more important point may be raised here. This has not been actually demonstrated, but with the knowledge already possessed of the transmission of the disease by fleas, open sores on the lower extremities would be subject to infection by these insects, and in this way it would not be surprising to find them playing an important part in transmission, especially in a country like this, where minor injuries to horses' legs are so common and fleas so numerous.

Miscellaneous.—Lingard has brought out the point that the disease may accidentally be transferred by birds picking sores on infected animals and following this on non-infected ones.

Railways have been mentioned as factors in the transmission of trypanosomiasis, and when they become more numerous in some of the infected zones they will no doubt play an important part in the spread of the infection, since they make possible a more rapid distribution of animals and also a greater dissemination of flies. However, as a means of transmission deserving consideration from a practical point of view in the Philippines, the possibility is very remote.

Theiler believes that in South Africa the propagation of the disease to a limited extent is influenced by the immunization of cattle against rinderpest with defibrinated blood. In Manila we have had a striking example of this possibility. Doctor Jobling, director of the serum laboratory, received from Java a number of cattle for serum work. One of these developed rinderpest and was bled to death, the blood obtained being used on four serum animals, three of which promptly developed surra and, of course, became useless for serum purposes. The infection in these cases undoubtedly came from the Java cow and illustrates too well what, as suggested by Theiler, no doubt frequently happens.

In following the discussion of the modes of transmission and infection it is seen that but few of the headings which have been chosen really have any practical significance; and we may well close this part of the subject with the statement, already emphasized, that trypanosomiasis is essentially a wound disease and that infection takes place when *materies morbi* are brought in contact with an injured surface and in no other way. The most common agents in bringing this condition about are biting and stinging insects, and of these certain flies and to a less extent fleas are the most important.

The manner of perpetuation.—The manner of perpetuation of a disease of this kind is interesting, since it has a practical bearing upon methods for its control. The eradication of the disease may with propriety be discussed at this point.

Musgrave and Williamson in a preliminary report, referring to this question, say: "The manner of perpetuation of an epidemic of trypanosomiasis in any country is a very important point in considering the prevention and eradication of the disease.

"By the very nature of parasites and of parasitic diseases in general, we know that unless the disease is continuous the parasite must have a natural host, or there must be a stage in its life cycle in which it can exist for an indefinite period outside the living body; otherwise the infection will disappear.

"Many of the large tsetse fly areas are absolutely destitute of domestic animals and probably some of them have never had one within their borders, and yet the flies in these districts are capable of infecting domestic animals. As it has been quite conclusively shown that the fly is not capable of carrying the infection at most but a short time it necessarily means that there is a source of infection from which the

flies are supplied, and the natural inference would be that the native source of infection is the wild animals in which the country abounds. It has already been shown that some of these animals are susceptible to the disease and that others harbor the parasites with little or no inconvenience. It is very probable that, were inoculation methods instead of microscopic blood examinations used for diagnostic purposes, a much larger percentage of these wild animals would be found infected than has generally been supposed.

"Conditions in certain sections of South America are very much like those in Africa, and the indications are that the epidemic is perpetuated there in the same manner.

"In India some observers claim that the cow acts as a host for the parasites over the long dry period in which there are not enough cases in horses to continue the infection. The probabilities are that a number of wild animals which exist in at least certain districts of India aid in this continuation. It is claimed that in certain sections of the country there are two varieties of animals which live in the bush, are susceptible to rinderpest and foot and mouth disease, but are not known to have 'surra,' though they are in infected areas. At certain seasons the flies are so numerous that these animals seek the open for protection from them. It would be interesting to test the blood of these animals by inoculation to see whether or not they are free from trypanosomiasis. In India camels also may play an important part in carrying the infection from one fly season to the next, as it is stated that these animals may live as long as three years after infection.

"From the foregoing, and if the disease continues to spread, it is evident that the wild animals of this country must be considered in dealing with the epidemic. If a certain portion of them are not already infected, it is only a question of time until they will be, and another difficult point in the solution of the problem will thus be produced.

"The part that rats play in perpetuating an epidemic has not yet been fully determined, but the fact that at this time, in the middle of the dry season, a considerable number of these animals are found to be infected, and with the knowledge before us that the infection may be transmitted from one rat to another by fleas, which are numerous on rats at all seasons of the year, makes it probable that these animals play a very important part in perpetuating the infection in the Philippine Islands and in other countries.

"However, so far as the city of Manila is concerned, it does not appear necessary to leave the horse family to discover how the infection is perpetuated. Now, even during the dry season, one can, almost daily, see a horse, sick with surra, driven along the streets; and biting flies, although not by any means as numerous as during the wet season, are still plentiful enough to continue the infection.

"The existence of an extra-corporeal stage of the *Trypanosoma*, living on grass and in water in marshy places, in this stage taken into the stomach of susceptible animals eating and drinking in these localities, and from this organ or other part of the animal economy passing into the blood in the forms we recognize, is without sufficient evidence to warrant consideration in this paper.

"Before leaving this subject, however, for a fuller discussion in a subsequent paper, it is proper to state that the *Trypanosoma* quickly die under all tried environments outside the body of some living creature, and no evidence of their existence in water, on grass, or other similar places can be advanced. Both water and grass have been inoculated with large numbers of *Trypanosoma* and have failed to convey the disease, after days, weeks, or months, when fed to susceptible animals, and also when injected under the skin."

Since writing the above, much information has been obtained with regard to the part rats play in the spread of the disease, and the evidence makes it important that these pests be taken into account in discussing the perpetuation of trypanosomiasis.

It is not believed that the rats of Manila were infected previously to the advent of surra, and this is supported by the evidence obtained by an examination of rats taken from zones free from the disease.

Surra beyond question is transferred from rat to rat, so that these animals soon become important factors in its perpetuation in certain zones. In Manila the annual destruction of thousands of rats with the purpose of preventing the spread of plague will also have a beneficial effect in limiting one agent in the transmission and perpetuation of surra.

GENERAL PATHOLOGIC ANATOMY.

Generally speaking, writers have been very brief in their description of the anatomical lesions of the different forms of trypanosomiasis, the majority agreeing that they are not constant or pathognomonic. Some, however, have held different views,

and have given excellent descriptions of their post-mortem findings, particularly Voges, and Sivori, and Lecler.

Laveran and Mesnil say that "nagana is certainly one of the diseases in which, at the autopsies of animals dead from the disease, there are slight lesions. Nearly all authors agree in giving as a constant lesion hypertrophy of the spleen. At the autopsy of one horse lesions of the internal organs were insignificant."

Voges states that in mal de caderas post-mortem examinations show œdema and roughened hair, just as they are present during life. The skin is removed with difficulty, and when taken off a very dry flesh similar to that seen in cholera is observed. Cloudy serous fluids are usually found in the serous cavities, especially of the chest, which may contain several liters. There are fibrous layers on the pleura and other serous surfaces, especially marked on the abdominal organs. The subpleural lymphatic glands are often enlarged. The spleen is enormously enlarged, sometimes hard and firm, and in other cases soft and friable. The follicles are often increased in size until they resemble grains of sago. The liver is enlarged. The kidneys are pale, and sometimes enlarged; the lymphatics are slightly so. Fluids are often found in the larger socket joints.

Schilling, writing of surra in Africa, says that post-mortem examinations show marked anæmia, especially of the lungs, and numerous, discrete, dark-red, subpleural spots; enlarged, soft spleen; enlarged follicles, and slight swelling and softness of the lymphatics of the neck, which contains a small amount of yellowish, opaque fluid. No special changes are observed in the liver and kidneys.

Sivori and Lecler, writing of "surra american," state that the adipose tissue is replaced by a gelatinous mass. The muscles have a rose tinge, but are pale and in parietic cases may atrophy. Citrin-colored fluid is present in the peritoneal cavity. The liver shows some increase in consistency and is darker in color. The spleen is enlarged and the glomerules are prominent and red; in the paraplegic form it is greatly increased in size and the lesions intensified, sometimes producing acute splenic tumor. There is enlargement of the Malpighian corpuscles, which are often so increased in volume as to stand out in relief on the surface. The bladder contains pale urine, which may show traces of albumen with or without blood or biliary pigments. The pleural cavity sometimes shows a small amount of exudate. The lungs may be normal or œdematous and in places congested. The pericardial cavity contains a yellowish serous fluid. The myocardium is pale and friable. The cardiac fat shows the same gelatinous changes as those of the subcutaneous tissues, and may show ecchymoses. The endocardium, particularly the left, has subserous punctate hemorrhages. The brain shows only an increased amount of subarachnoid fluid. Sections of the spinal cord usually show no lesions, but there may be small hemorrhages in the gray matter. These authors do not consider all the lesions attributable to *Trypanosoma*, some of them being due to secondary infection. They do not believe *Trypanosoma* destroy the red blood cells mechanically, but think they are destroyed by mononuclear macrophages. The mode of production of œdema, they say, is unknown.

Bruce mentions as the anatomic lesions in nagana a gelatinous atrophy of the subcutaneous tissues, subserous and subcutaneous ecchymoses, and enlargement of the spleen.

Weber and Nocard, writing of dourine, say that the section shows cachexia and hemorrhagic softening of the spinal marrow. The parasites found in these areas and in the serous effusions resemble those of surra, nagana, etc.

Kanthuck, Durham, and Blandford give as marked lesions enlarged lymph glands, especially around the inoculated wound, hypertrophy of the spleen and liver, and often fatty degeneration of the latter. Iron reaction is obtained with the liver, the spleen, and the kidneys.

Curry gives as the principal anatomic lesions marked pernicious and progressive anæmia, general subserous œdema, especially of the belly, sheath, and legs, moderate glandular enlargement, frequently broncho-pneumonia and bronchitis, and often profuse muco-purulent nasal discharges, with marked glandular enlargement, particularly of the submaxillary glands.

In our experience necropsies have revealed anatomic pictures rarely as characteristic in the chronic diseases peculiar to man. The antemortem lesions, provided the necropsy is made shortly after death, are still present. The body is emaciated, and the bands of œdema, so prominent during life, may still be seen. A small amount of yellowish-tinged, gelatinous mucoid substance is found in the inner canthi of the eyes and even in the nostrils. The hair is roughened and often scant, leaving a scrawny, roughened epidermis. The mucous membranes are pale and dry looking and often show a yellowish tinge. The hide, as pointed out by Voges, is removed only with great difficulty, except in areas of subcutaneous infiltration, and when removed exposes the dry, hard, pale subcutaneous tissues. In the regions corre-

sponding to the oedema during life are found yellowish-tinged, gelatinous infiltrations, which are of a similar consistency. A like condition is found throughout the body in the regions where adipose or areolar tissues are located, and especially is this true of the fat around the heart and the subperitoneal tissues. The muscles are pale, wasted, coarse, and granular looking. The serous surfaces, particularly the peritoneum and the pleura, often show flakes of plastic fibrous material. These are particularly numerous over the surface of the liver and sometimes in the spleen. All the tissues and organs have a peculiar dry, pale appearance, which has been so aptly compared by Voges to their condition in cholera. There are numerous subserous hemorrhages, particularly on the right side of the heart and over the lower portions of the lungs. The lymphatics are in general somewhat enlarged, and often markedly so; and in a certain percentage of cases areas of broncho-pneumonia are present. The heart muscle shows parenchymatous changes, depending somewhat on the duration of the disease. Its chambers usually contain chicken-fat clots, which often extend for a foot or more into the aorta. The appearance of the spleen varies somewhat, but in the majority of cases it is considerably enlarged, friable, and somewhat soft. The surface is uneven, due to the enormously swollen corpuscles, which stand out prominently on the surface. On section a typical sago spleen is often seen, while in other cases a typical acute splenic tumor, such as is present in infectious diseases of man. In a few cases the spleen is but slightly swollen, but the dotted appearance, due to the swelling of the corpuscles, is a constant lesion and gives to this organ, regardless of its size, a most characteristic picture.

The liver is usually somewhat enlarged, pale, and cloudy. The intestine shows lesions due to anæmia, with now and then small ulcerations in the upper portion and sometimes in the cæcum. The aqueous humor is often cloudy and contains *Trypanosoma*. The urticarial eruption observed during life is no longer evident. In some of the lower animals the scrotum, and even the testicle in the male and the vulva in the female, is greatly enlarged, and in the male rabbit the tension may be so great as to rupture the scrotum. Small prepuceal or labial ulcers are not uncommon.

GENERAL REMARKS ON SYMPTOMATOLOGY.

Before proceeding to the study of trypanosomiasis in the various animals, it might be well to make a few remarks on the symptomatology of the disease.

There is considerable variation in the clinical picture of surra in the same class of animals, even when the infecting parasites are known to be the same, and it is therefore not surprising that variations should exist in different species. In reviewing the literature relating to dourine, nagana, surra, and mal de caderas, one is struck with the great similarity in the descriptions of the so-called different diseases. A comparison of the descriptions of any one of them, as given by different writers, shows as great a divergence as may be found with those of the diseases acknowledged to be different. In all of them, however, there are a number of practically constant characteristic symptoms in the well-established infection such as to make, when taken together, a clinical picture easy to determine accurately, even without the aid of the microscope.

After an incubation period, which varies in the same class of animals and in those of different species as well as with the conditions of infection, and during which the animal remains perfectly well, the first symptom to be noticed is a rise of temperature, and for some days a remittent or intermittent fever may be the only evidence of illness. Later on the animal becomes somewhat stupid; watery, catarrhal discharges from the nose and eyes appear; the hair becomes somewhat roughened and falls out in places. Finally the catarrhal discharges become more profuse and the secretion more tenacious and even purulent; marked emaciation develops; oedema of the genitals and dependent parts appears; a staggering gait, particularly of the hind parts, comes on and is followed by death.

Voges divides the symptoms of mal de caderas into two stages, as follows: On the fourth or fifth day after inoculation the temperature rises rapidly, sometimes to 40° or 41° C., and then suddenly falls to normal or nearly so, usually on the second day. Within five days there is another rapid rise, reaching 40° C., followed by another sudden fall. These reactions may be repeated from 2 to 8 times during the course of the disease. This is called by Voges the first stage. During this period the appetite is good and there is no emaciation. The thirst is increased. The feces are normal, but in rare instances may show a little clotted blood. Transient hemoglobinuria. The reflexes are normal. The coat is smooth, and the hearing and sight normal. Toward the end of this stage weakness becomes noticeable.

In the second stage the fever becomes less intermittent and exacerbations to 40° C. or over are exceptional. The remissions are also less marked. The animal becomes inactive and sluggish and allows the head to drop carelessly. Progressive emacia-

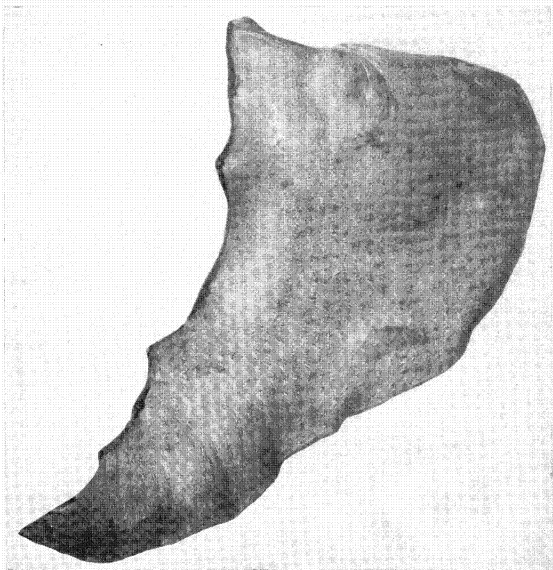


FIG. 106.—SPLEEN OF A HORSE DEAD OF SURRA, SHOWING ENLARGED FOLLICLES AND HEMORRHAGES.

tion takes place. Great thirst. Progressive weakening. Edema, particularly of the hind legs, belly, and scrotum. The hair loses its gloss. Decreased sensibilities. Digestion and respiration remain good. The gait becomes staggering and finally causes the animal to fall over. Some animals die suddenly during the later stages of the disease. Just before death the temperature variations usually become greater, vacillating between 34° and 39° C.; and death generally occurs when the temperature is low.

The fever is not continuous or characteristic in any of these diseases. It may be intermittent, remittent, or, according to some writers, relapsing in character, varying from 39° to 41.5° C. It is nearly always higher in the afternoons.

In describing the epidemic of surra, which visited Java in 1900, Schat gives among the symptoms of the disease some which are remarkable in that they differ radically in many respects from those described by other observers. In reading his work one is struck by the fact that they form a very clear description of rinderpest in carabao. He found *Trypanosoma*, however, and it would appear to us that he was working with a combination of the two diseases.

A great deal of work has been done by various writers to demonstrate the relation of the temperature to the number of parasites in the circulating blood, some maintaining that these are numerous in proportion to the temperature and others showing that no relation whatever can be determined. Kanthuck, Durham, and Blandford say that the parasites appear in the blood early in the disease and continue to increase until death. The counts vary and may reach 2,000,000 to 3,000,000 per cubic millimeter. The parasites appear to multiply first in the lymphatic glands around the point of inoculation and then to enter the blood, a fact which they believe explains the short latent period during which, after inoculation, they can not be found in the blood. Multiplication occurs also in the infected area.

During the incubation period parasites are not found in the blood by microscopic examination. This has been explained in various ways. Voges considers this to be because of their rarity, while others maintain that a stage of multiplication goes on in the lymphatics. A few conclusive experiments by animal inoculation, however, have shown that the circulating blood is infectious for one, two, or even several days before parasites are found by microscopic examination to be present, which would seem to indicate, as has been suggested, that they exist in the blood in small numbers during at least a portion of the time.

The periodical disappearance of the parasites from the circulating blood for varying lengths of time during the course of the disease has not been satisfactorily explained. All kinds of conjectures have been offered, with but little evidence to support them. Voges's idea regarding this seems to us to be the most plausible. He states that the parasites are numerous during the first few days after the rise in temperature, following which they mysteriously disappear; and this appearance and disappearance may take place a number of times during the course of the disease. He considers it due to a certain amount of immunity which is acquired by all animals in the early stages, and which may be repeated a number of times before the animal becomes too weakened. This view is advanced in preference to the opinion that the temperature plays any part in this phenomenon. In the later stages of the disease parasites may be found in the blood in larger numbers and with a higher temperature than at any time previously.

Another symptom in this disease, difficult of explanation, is the anæmia, which is progressive from the first. It has been explained that the parasites mechanically destroy the red blood cells and interfere with their manufacture in the bone marrow, and finally, that on account of certain changes produced in the blood by the parasites, the red blood cells are taken up by the large mononuclear macrophages. A number of less important explanations have been given. According to Voges, anæmia is a constant, prominent symptom; and 10,000,000, the normal number of red blood cells in the horse, may be reduced to 4,000,000, 3,000,000, and even 800,000 in some cases before death. The sedimentation ring of leucocytes is increased and may be larger than that of the red blood cells. The hemoglobin is decreased in proportion to the diminution in the number of red blood cells; from the normal of 13.1 per cent it may fall to 3 or 4 per cent.

Several observers have spoken of the mechanical destruction of red blood cells by the parasites. Voges saw *Trypanosoma* hold erythrocytes against the body by their fixed ends until the cells disappeared. Crookshank, on the other hand, was unable to satisfy himself that they attack the red blood cells.

Laveran and Mesnil do not consider anæmia sufficient to account for the death of animals. They say that the manner in which the parasites act is still unknown.

There is certainly something very curious about the presence of anæmia in this disease and in the action of the parasites in producing it, as well as bringing about death. The mechanical destruction of the red blood cells is not of the importance

many writers attach to it. It seems to us that there is some factor in addition to mechanical action, which causes such profound changes, and strong evidence in favor of this is found in the peculiarity of the gelatinous deposits. The parasites appear in some manner to produce, or cause some part of the animal economy to liberate, this peculiar substance, which is not a simple infiltration of fatty tissue, but is of a different character. The deposit undoubtedly is formed gradually, as is inferred from the slow change in the secretions. The discharges from the nose and eyes, at first watery, gradually take on the same character, and before death become very tenacious and solidified in the nose and corners of the eyes.

Referring to the action of *Trypanosoma* in the animal economy Laveran and Mesnil state:

"Evidently, in the presence of an infection so intense as that which is shown at the moment of death of rats, mice, and other animals, the mechanical action of such a number of parasites is to be considered. This alone, however, in our opinion does not suffice to explain the cause of death. Rats infected with *Tr. levisii* may have a great number of parasites and yet feel no inconvenience. In certain attempts at treatment, of which we shall speak later, a rat has had for more than fifteen days as many parasites in the blood as red cells.

"One is led to think of a toxic action of the parasites and of the intervention of the soluble products excreted by them. The observations of the course of the disease in rabbits, guinea pigs, and cows, in which the parasites are not so large as in other animals, even at the time of death, and the profound dejection of certain animals when infected, as the ass, plainly corroborate this view."

Strong reported: "Large amounts of blood taken from monkeys suffering with experimentally produced trypanosomiasis of severe type were passed through a Berkefeld filter and the filtrate injected into other monkeys. No symptoms of trypanosomiasis were produced. Large celloiden capsules containing blood with many parasites were placed in the abdominal cavities of sheep, but the results were also negative."

All attempts to isolate a toxin have proved futile. It does not seem to us that a toxin can enter into consideration; but, as has already been said, the character of the action which results in the formation of the peculiar gelatinous deposits will probably lead to a solution of the problem.

Voges believes that in mal de caderas death usually results from a gradually progressive heart failure, and in some cases occurs suddenly from the same cause. He says that death usually comes on with a fall of the temperature, rarely at its height.

This statement is true, but does not go far enough; an explanation of the cause of heart failure is what is desired. The condition described above may offer some solution, in that the gelatinous deposits are often abundant around the heart, and a microscopic tissue shows that a similar condition is present in the myocardium.

The incubation period of the disease in different animals has an important bearing upon the application of methods for the control of epidemics. It will be discussed in detail as the study of the disease in different animals is taken up. The evidence of previous workers and our own observations show that it varies with the manner of inoculation as well as with other conditions.

In all the forms of trypanosomiasis the infection seems to involve particularly the genitalia, the skin, and the organs of special sense. The skin symptoms consist in a roughening of the hair, which also falls out in places, a thickening of the epidermis, often with exfoliation, and in some stages of the disease various skin eruptions. These may be simple erythema, and more rarely they may assume the severer forms, as urticaria, or in extreme cases a distinct localized ulceration may occur. The scrotum and penis in the male and the vulva in the female are often swollen, and ulcerations of the penis or vulva are frequent symptoms, especially in dourine.

TRYPANOSOMIASIS OF HORSES.

We shall begin the discussion of trypanosomiasis in the different species of animal with that of the horse, which, from an economic standpoint, is the most important animal naturally susceptible to the disease in the Philippine Islands.

Most of the writings relating to trypanosomiasis deal particularly with the infection in equines, and as a consequence literature is rich in descriptions which in many points can not be improved upon. It is our intention briefly to review the most important writings on surra, nagana, dourine, and mal de caderas in each species of animal, following this with our own observations, and finally, when through with the species discussed, to devote a chapter to the discussion of the individuality of these diseases.

Surra, according to Lingard, manifests itself, after a period of incubation, in fever, a stumbling gait, and general or localized eruptions, with the presence of *Trypanosoma*

Chart I

RECORDS OF TEMPERATURE, PULSE AND RESPIRATION.

Horse No CXLX - Hospital - Bomby Tramway Company
 Disease: Surra naturally contracted Date of Attack: 4th December 1899 Remarks: Death
 Age 8 Sex: Gelding Colour: Chestnut
 Date of Birth: 27.85 Registry No: CXLX Word

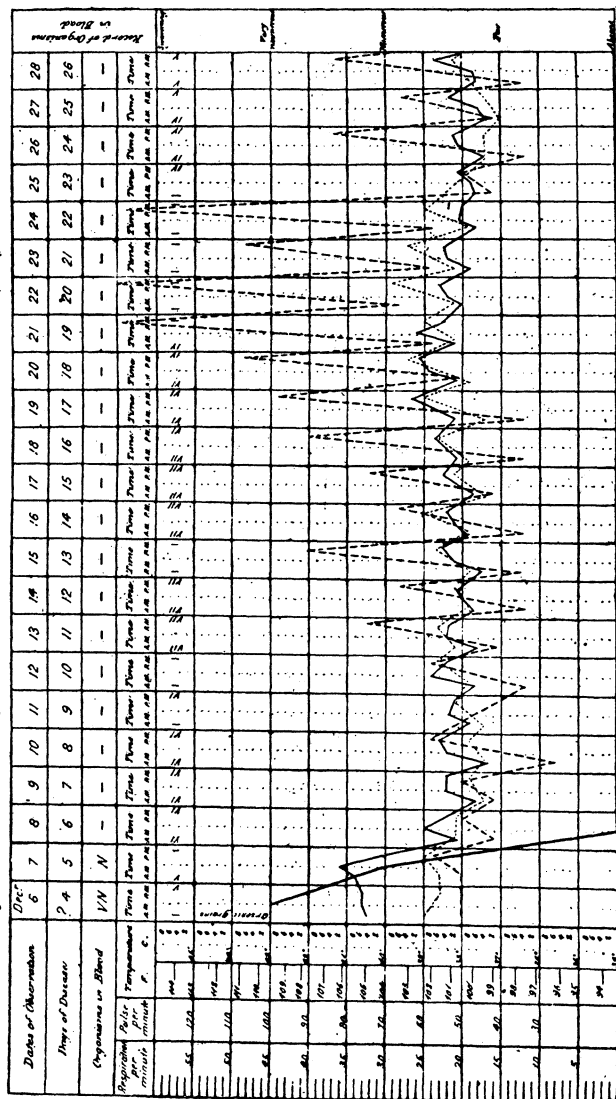


Fig. 107.—Temperature record of surra in a horse (after Lingard).

RECORDS OF TEMPERATURE, PULSE AND RESPIRATION.

Horse No Cxix

[illegible][illegible]

<u>Temperature</u>	Pulse
<u>Hematozoa,</u>	Respiration

FIG. 107—Continued.

Chart III.

RECORDS OF TEMPERATURE, PULSE AND RESPIRATION.

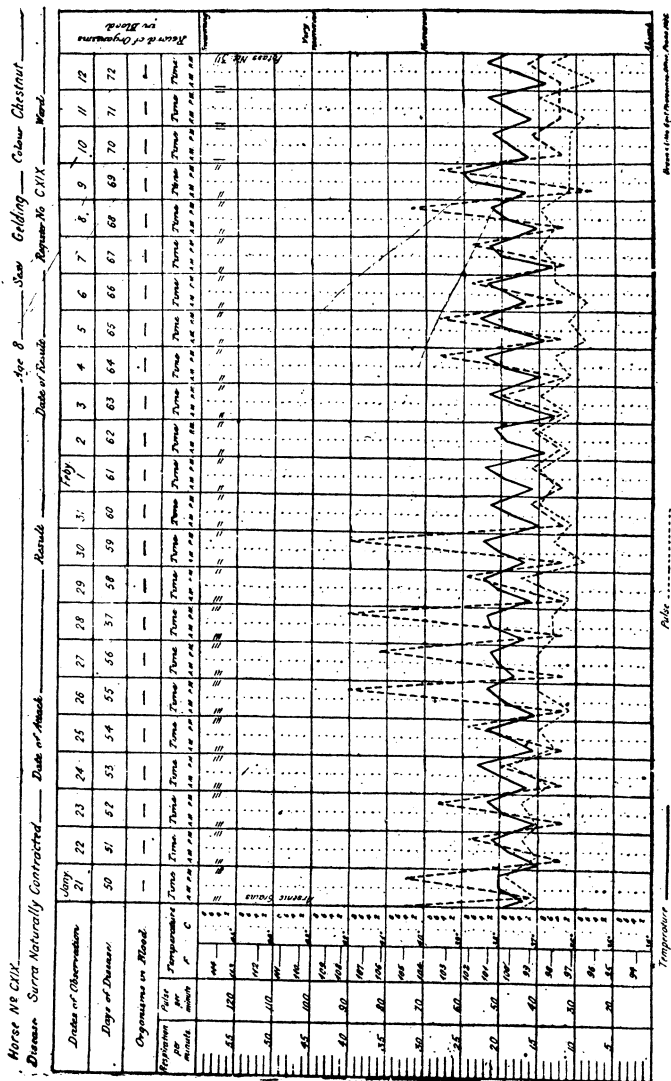
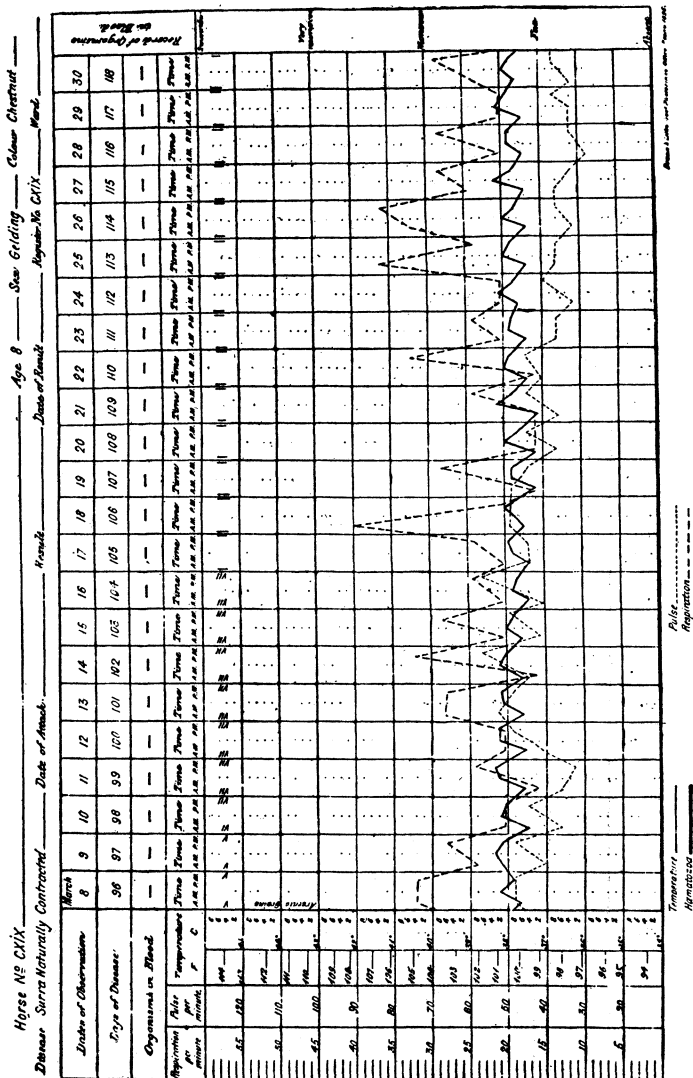


Fig. 107—Continued.

Chart V.

RECORDS OF TEMPERATURE, PULSE AND RESPIRATION.



SURBA

Chart VI.

RECORDS OF TEMPERATURE, PULSE AND RESPIRATION.

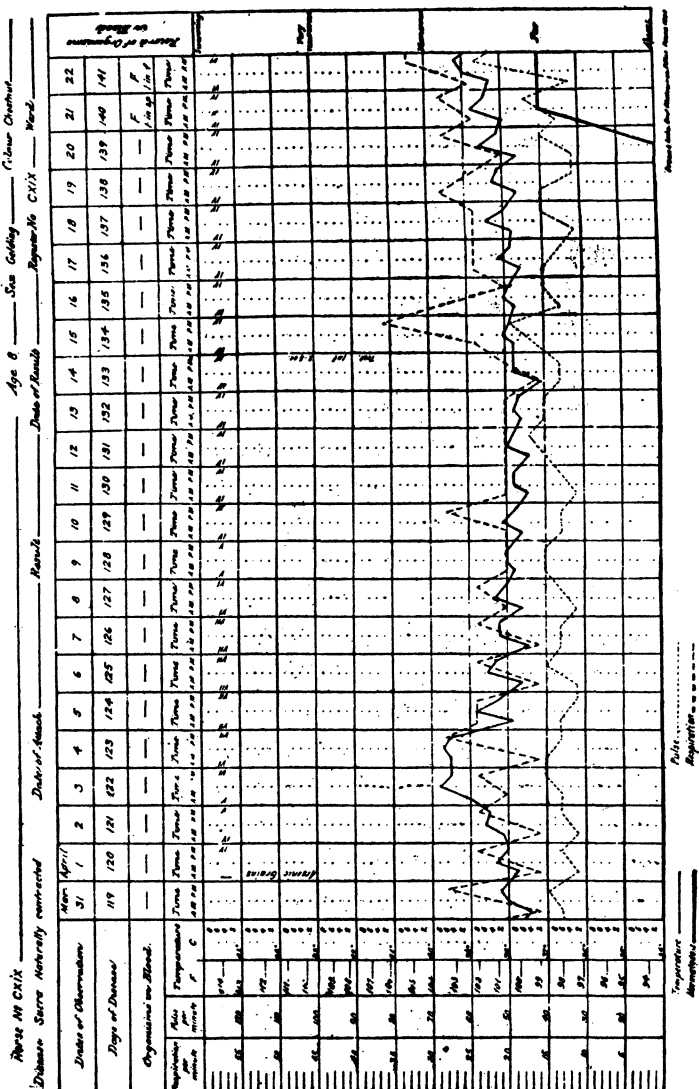


Fig. 107.—Continued.

SURRA

Chart VII

RECORDS OF TEMPERATURE, PULSE AND RESPIRATION.

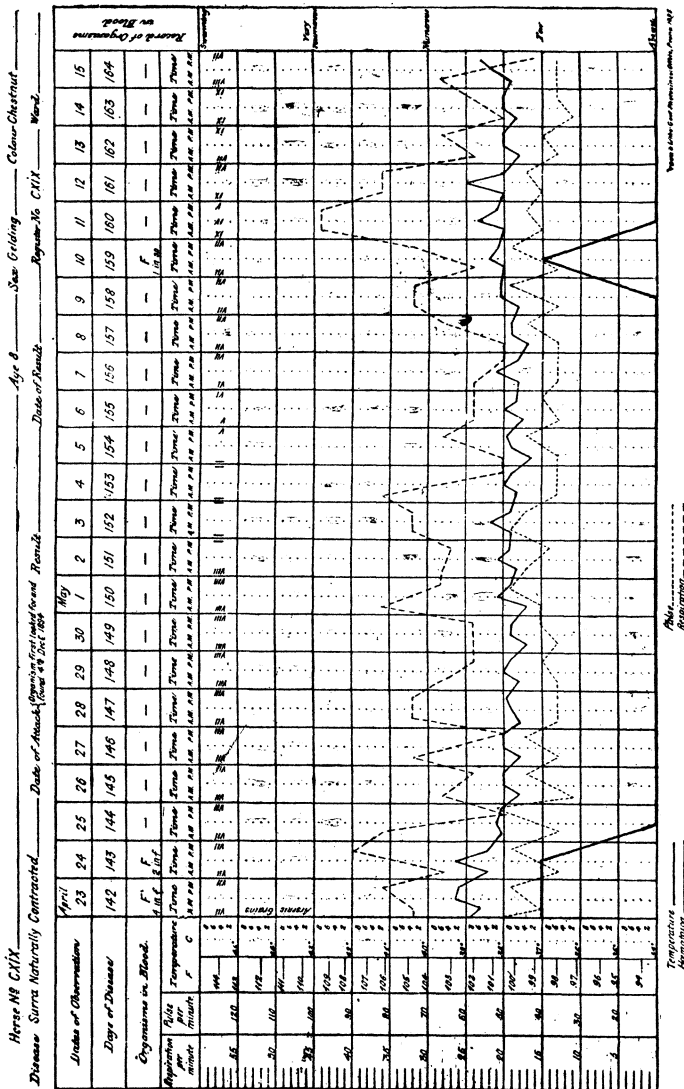


Fig. 107—Continued.

Chart I RECORDS OF TEMPERATURE, WATER TAKEN, URINE PASSED AND TOTAL UREA EXCRETED.

DOG SURRA

Acrobasis. Inoculated from Dog II (Urease, Naturally acquired) with 1.0 cc. of blood containing very numerous Acrobasis. Age 7. Sex: Belting. Colour: Bay. Disease "Surra" (inoculated). Date of inoculation, 25-7-93. Remarks: Death. Date of death, 7-9-93. Regimen No. XCIII.

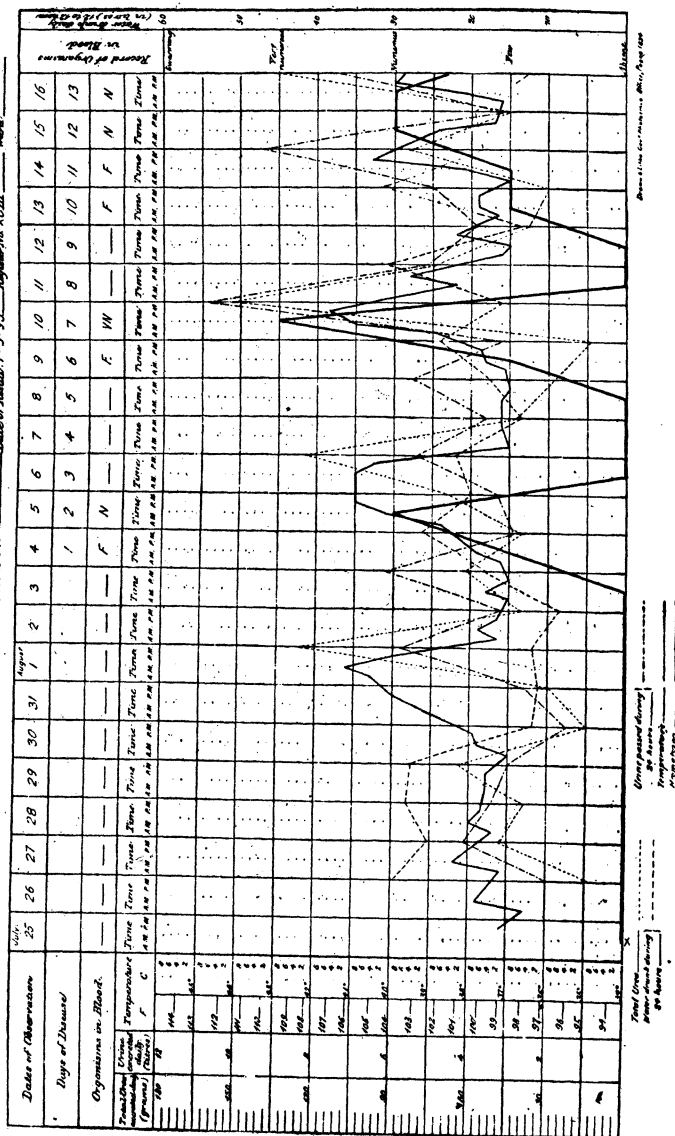


Fig. 108.—Temperature record of surra in a horse (after Lingard).

DOG SURRA
15

Chart II

RECORDS OF TEMPERATURE. WATER TAKEN, URINE PASSED AND TOTAL UREA EXCRETED:

Antigen: Inactivated : in 1000 T (Disease naturally acquired).

Disease Summ (Inoculated)—

Date of Inoculation. 25-7-93.

Results. Death.

Results

Register

No. XCHL—

Word _____

1

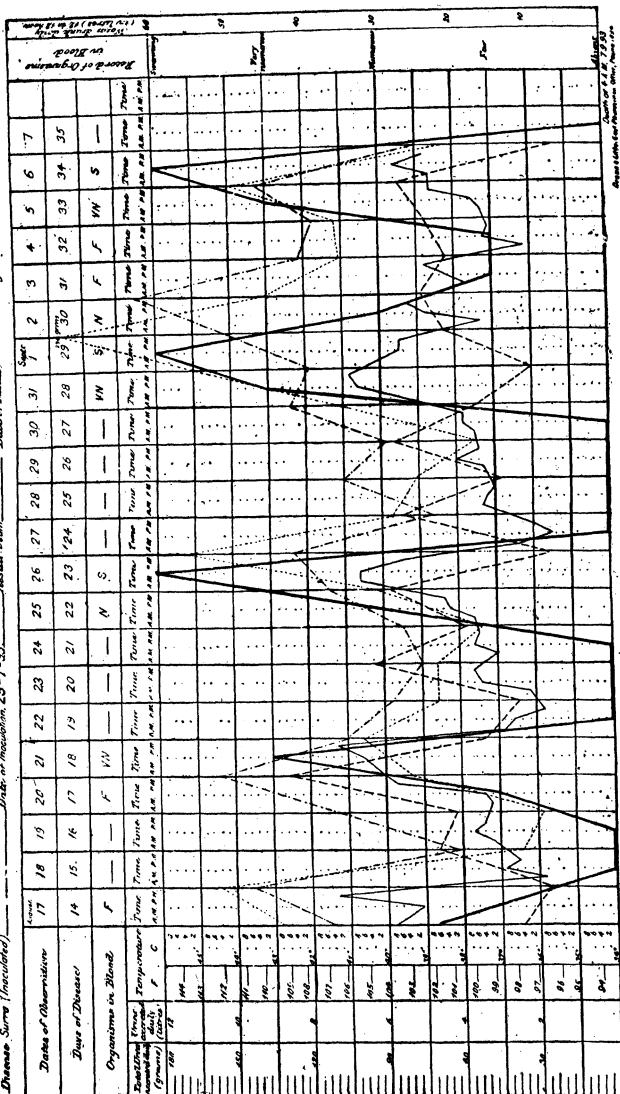


FIG. 108—Continued.

Charl I

R. S.

RECORDS OF TEMPERATURE, PULSE AND RESPIRATION.

Australian Mare _____ Age, _____ Sex, _____ Colour, _____
Disease. *Surra from Cow* _____ Date of Incubation, 3. 9. 32 _____ Result, Death _____ Date of Result, 22. 9. 32 _____ Register, No. XXX

Australian Mare

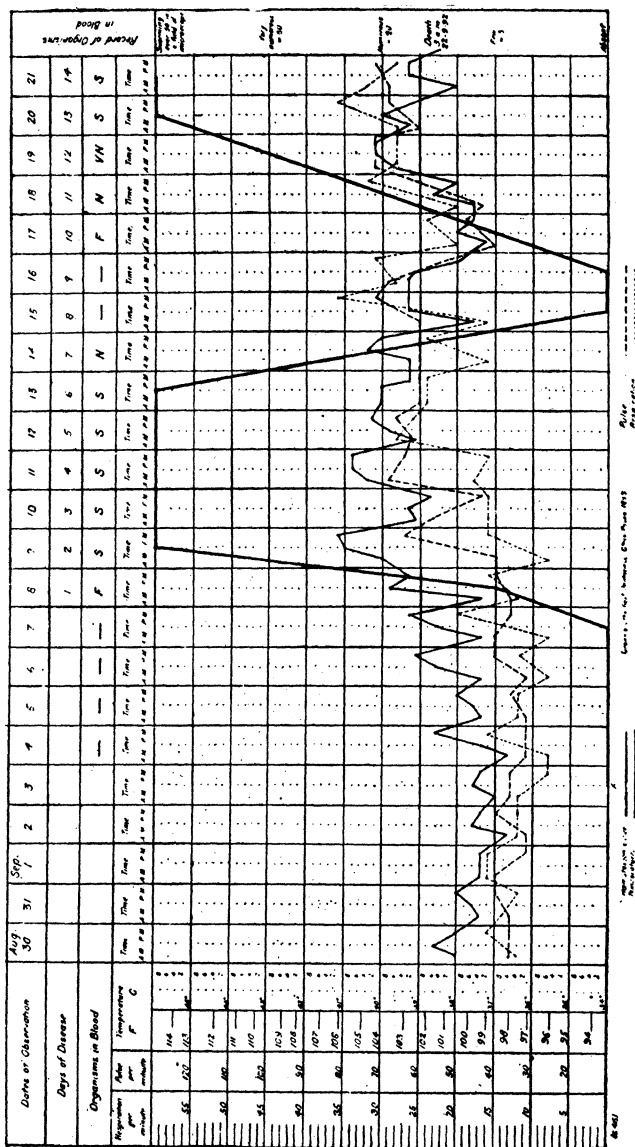


Fig. 109.—Temperature record of surra in a horse (after Lingard).

in the blood. A period of apyrexia may here supervene, lasting for a day or so, during which the animal appears better. These apyrexial periods may occur a number of times during the course of the disease. In every instance, however, they are followed by a fever, usually from 38.7° to 40° C., thirst, slight loss of appetite, ecchymoses of the conjunctivæ, with increased lachrymation, and mucous discharge from the nostrils. The submaxillary glands may be enlarged, and œdema beginning on the legs or sheath may develop. Emaciation is rapid and progressive. With each exacerbation of fever the other symptoms become intensified and the animal is made weaker. The œdema spreads, the mucous surfaces become very pale and tinged with yellow, and the respiration is quickened. The appetite remains good. Toward the end paresis of the hind quarters becomes noticeable. Paralysis of the sphincter ani is frequent. Shortly before the end the heart's action in many cases becomes violent, and death may result suddenly from heart failure. When this does not occur, the animal finally falls to the ground and dies from exhaustion.

Nagana is carefully described by Bruce, who gives as the principal symptoms, fever of a remittent or intermittent type; catarrhal secretions from the nose and eyes; staring of the coat; and œdema of the abdominal region, the prepuce, and the posterior extremities. The animal becomes markedly emaciated and has a dejected appearance, the head hangs, the hair becomes very rough and in places falls out, the mucous membranes of the eyes and genitals become very pale, and there is generally a slight opacity of the cornea. Just before death the animal falls to the ground and dies, apparently without suffering.

Kanthuck, Durham, and Blanford inoculated two horses, one of which, a well-fed Russian cart horse, lived seven weeks, and the other eight days. Wasting was very conspicuous. The period of incubation was followed by a smart rise in temperature and by the appearance of parasites in the circulating blood. A sudden rise of temperature immediately followed each increase in the number of parasites in the blood. At the time of death there was marked fever.

Laveran and Mesnil report two cases, as follows: The first symptoms were the appearance of parasites in the blood, and fever. One of the horses, which was not in a good condition at the time of inoculation, died in sixteen days; the other in forty-three days. With one or two exceptions parasites were always found in the blood by microscopic examination. The red blood cells gradually diminished and at death were reduced to half their original number, or even less. Parasites appeared in the blood in less than four days after subcutaneous inoculation, and their appearance was coincident with the first rise in temperature, which in a few days reached 41.4° C. This was followed by a drop to 38° C., and a corresponding reduction of the number of parasites in the circulation. With the second rise of temperature to 40° C., where it remained oscillating between 38° and 40° C. until the day of death, the parasites again became numerous and remained so throughout the disease. Beginning about the fifteenth day after inoculation, there was œdema of the penis, gradually involving the belly, but not the posterior extremities. Lesions of the nose and eyes were not noticed. The appetite, except at the height of the fever, was good. There was no apparent emaciation and no serious loss of weight.

During the incubation period of mal de caderas, according to Voges, no symptoms are noticed, but as the disease progresses the animal becomes inactive and heedless of what is going on about it. It allows the head to drop carelessly, and the whole body loses its firmness and becomes more and more sluggish. On being ordered it responds very lazily, and "even the wildest and meanest horses no longer balk and bite." At this period of the disease the animal may fall to the ground and die suddenly. On the other hand, if assisted to rise it may live for as much as two weeks.

Following the incubation period, which varies in duration, the temperature rises rapidly, often to 40° and 41° C., and on the following day falls to normal or nearly so. It then goes up again, and within five days reaches 40° C. or more. The period of apyrexia between these elevations is of uncertain length. This Voges calls the first stage of the disease, the important symptom being the intermittent fever.

In the second stage the fever is prominent, but the intermissions become less marked as the disease advances, the temperature varying from 38.5° to 39.8° C.

Before death great variations, sometimes from 34° to 39° C. from morning until evening, may occur, the curve being as irregular as a septic one.

Hemoglobinuria may occur temporarily in the first stage of the disease. Red blood cells are usually present in the stools, which as a rule are normal in consistency and number, but in rare instances may be covered with a mixture of coagulated blood. Thirst increases and becomes marked as the disease progresses. The pulse is at first normal, but the heart grows weaker with the course of the illness, finally allowing the œdema which is seen in the later stages. Sudden death from heart failure sometimes occurs.

Animals with mal de caderas show no evidence of pain. During the first stage the reflexes are normal, but even as early as this there may be a diminished sensibility, which later on becomes marked, so much so that animals pay no attention to swarms of flies. Incoordination affecting particularly the hind parts becomes so severe that the animal reels as if drunk.

The hair remains smooth and glossy during the first stage, and shedding, if present, is normal. In the second stage it loses its gloss and lies less smooth. Emaciation is not noticeable during the early part of the disease, and with good food animals often gain in weight; but during the later periods this symptom is marked and the loss may reach 100 kilos or more before death. The appetite, as a rule, is not disturbed, but continues good to the end, and in some cases it is noticeably increased.

Dourine is a recognized form of trypanosomiasis in horses, but clinical descriptions are not so complete as for the other types. It is usually referred to as resembling one of the other forms. The emphasized symptoms, in addition to the ones already given, consist in phlegmanous ulcers of the genitalia and to a less extent of various parts of the skin. The temperature, as a rule, does not run so high in this form of the disease as in the others, and parasites are much less numerous in the peripheral circulation. On the whole, the course is considered more chronic than that of surra and the variety of susceptible animals is smaller.

As to the general description of the symptomatology of the disease as observed in the Philippines, we have nothing to add to the classical ones of the various writers in India, South America, and Africa.

With the ultimate object of discovering methods of prevention and cure, toward

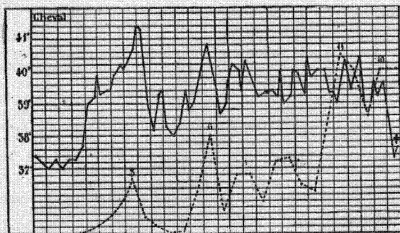


FIG. 110.—Nagana in a horse (—) temperature, (....) *Trypanosoma*. (After Laveran and Mesnil, 1902, fig. 4.)

which all of our work is directed, one of the most important questions to decide and one which so far has not been definitely determined is the incubation period in naturally contracted cases. Authors writing of the disease under the same and different names give for it various lengths of time, and not a few say that it is unknown.

Evans fed two horses 20 ounces each of surra-infected blood, obtaining positive results and an incubation period of six days. He did not prove his animals free from infection at the time of feeding, does not state that biting insects were excluded, and of course can not say that there were no lesions in the mouth.

Lingard fed a horse frequently with small quantities of infected blood well diluted in water, with an incubation period of one hundred and thirty days or less, depending upon which feeding produced the infection. To another horse he fed 200 minims of infected blood in a similar manner, the incubation period being, according to the author, seventy-five days. These experiments are open to the same criticism as those of Evans.

Subcutaneous injection.—In twelve horses inoculated subcutaneously by Lingard, the average incubation period was five and two-thirds days, the longest being eight days following the injection of 1 cubic centimeter of blood containing but few *Trypanosoma*, and the shortest four days, which occurred in four of the horses after the inoculation of 1 to 3 c. c. of blood containing *Trypanosoma* in large numbers. In three horses injected subcutaneously with blood taken during the intermissions of the disease and microscopically free from parasites the average incubation period was eight and two-thirds days, the longest being ten days and the shortest four. In

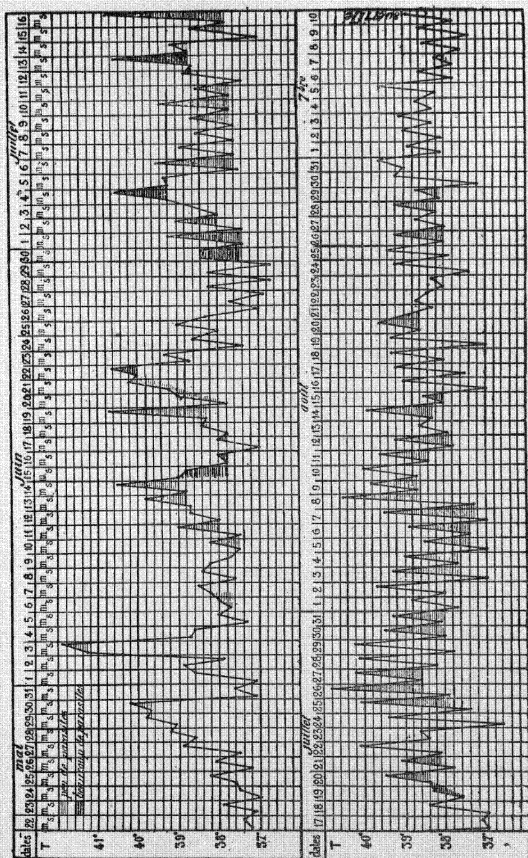


Fig. 111.—Temperature and its relation to the number of parasites in the peripheral circulation in "surra americana." (After Lignieres, 1908, fig. 10.)

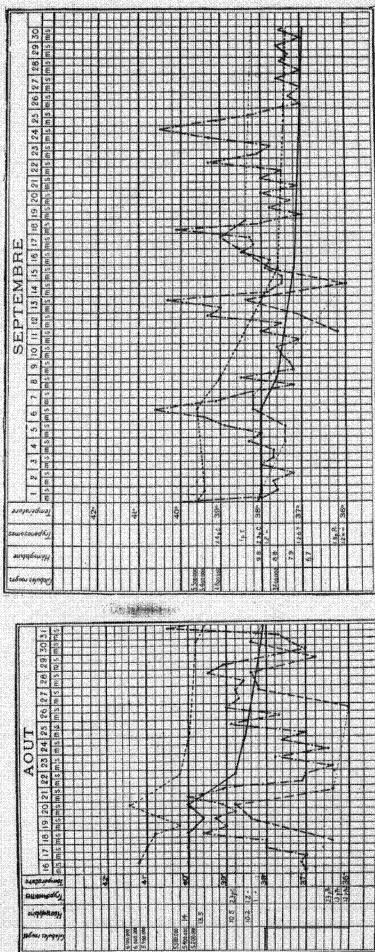
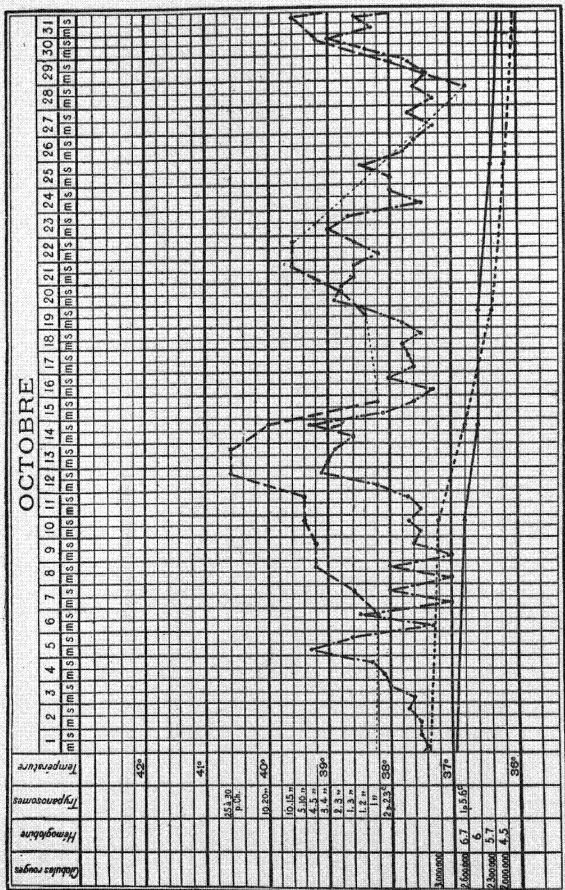
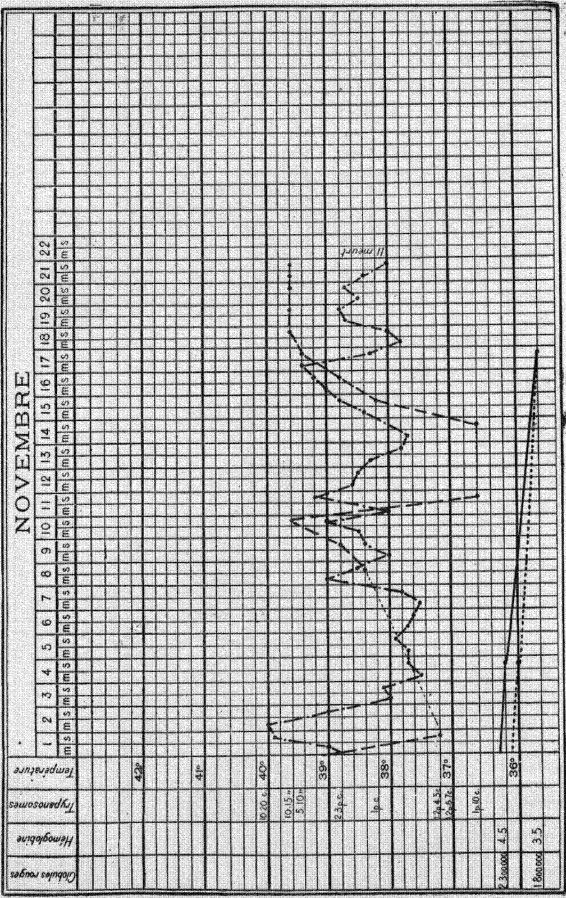


FIG. 114.—"Surra american" in a horse. (After Sivori and Lecler, 1902.)





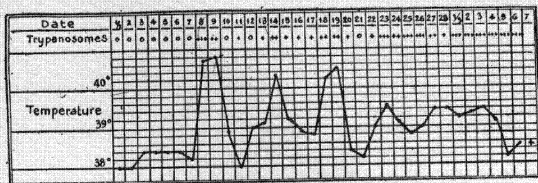


FIG. 112.—Temperature chart of a horse following intravenous injection of 20 c. c. of blood obtained from a horse which showed no parasites in the blood. Dead in thirty-four days. (After Lignieres, in *Recueil d. Med. Vet.* vol. 10, No. 4, Feb. 28, 1903, p. 117.)

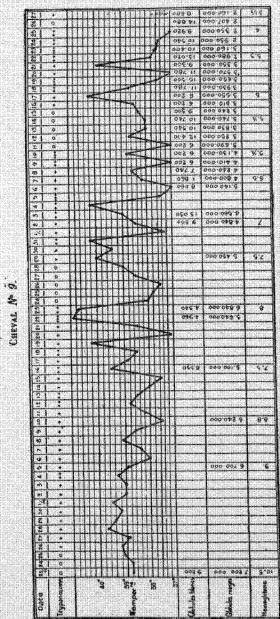


FIG. 113.—Temperature record of a horse inoculated intracerebrally with *Trypanosoma* from a dead rat. (After Lignieres, 1903.)

twelve horses inoculated subcutaneously with blood taken one and one-half to sixteen hours post-mortem, the average incubation period was nine and one-half days, the longest being thirteen days following the injection of 2 c. c. taken one and one-half hours post-mortem, and the shortest six days in a case of inoculation with 6 c. c. of blood taken one and one-half hours post-mortem.

In two cases of subcutaneous injection of 1 and 2 c. c. of serum taken forty-five minutes and two hours, respectively, post-mortem, from a horse dead of the disease, the incubation periods were eight and nine days. A horse injected subcutaneously with 1 c. c. of blood from the tunica vaginalis of a goat suffering from the disease developed an incubation period of five days, and a horse inoculated with 1 c. c. of the blood of the same goat had one of thirteen days.

BUREAU OF GOVERNMENT LABORATORIES.
BIOLOGICAL LABORATORY.

ANIMAL RECORD.

Horse No 147

January 7, 190³

Weight 700 lbs. Age 8 yrs. Sex Male Color Bay Inoculation Received with surra.

History

Bay native pony in good condition.

TREATMENT.	34	35	36	37	38	39	40	41	42	Date.	RESULTS.
										Jan 7	Tryp. pos.
										8	Tryp. pos.
										9	
										10	Tryp. pos.
										11	
										12	Tryp. neg.
										13	Tryp. neg.
										14	
										15	Tryp. pos.
										16	Tryp. pos.
										17	
										18	
										19	
										20	Tryp. pos.
										21	Dead.

FIG. 115.—Temperature record of surra in a horse.

There are numerous observations to show that the incubation period in naturally contracted cases does not vary more than in experimental cases. It is usually from four to seven days, although in exceptional cases it may be more. In one of our animals, in which the evidence was complete, it was eleven days.

The incubation period in horses artificially infected by us varied somewhat with the condition of the animal, the place of inoculation, the character of the infecting material, and perhaps with other causes; but from observation we are certain that variations in naturally contracted cases are not greater and that they occur within

comparatively small limits, in most cases from four to seven days. One of our horses had an incubation period of eleven days, and another, which was suffering with a malignant growth and a temperature of 39.5° to 41° C., had one of eighteen days following a subcutaneous injection. As already stated, we are convinced that the naturally contracted disease does not differ from that produced by inoculation in the length of its incubation period, its symptoms, or any other respect.

Fever is one of the most important symptoms and is the first clinical evidence of infection. It can usually be determined during the incubation period in exposed animals. The temperature as a rule rises very rapidly, and during the first few days may reach 40° to 41° C., after which it becomes irregularly intermittent, remittent, or, in rare instances, relapsing in type, always being highest in the afternoon.

BUREAU OF GOVERNMENT LABORATORIES.
BIOLOGICAL LABORATORY.

ANIMAL RECORD.

Horse No 50
September 16, 190 2
Weight 450 lbs Age 3 yrs. Sex Male Color _____ Inoculation _____ Received with _____
History _____ Native pony, emaciated, hair ruffled, enormous edematous distention of penis, from which lymph is exuding. Numerous parasites in the blood.

TREATMENT.	34	35	36	37	38	39	40	41	42	Date.	RESULTS.
										Sept 16	
										17	Tryp. few.
										18	
										19	
										20	
										21	Tryp. neg.
										22	Tryp. pos.
										23	
										24	Tryp. neg.
										25	Tryp. pos.
										26	
										27	
										28	Dead.

Fig. 116.—Temperature record of surra in a horse.

The especial value of the temperature in diagnosis is its mere presence in connection with other symptoms. There is at any time very little in its variations which is characteristic enough to be very significant, but taken over a long period, its course, while not constant, makes a suggestive picture.

The illustrations (see figs. 101-104, 115-118) give an idea of the course of the fever in horses in Manila.

Simple observations of a horse suffering with this disease do not afford sufficiently exact data during the very early stages, but as the disease progresses they become of the greatest diagnostic value.

The hair, at first normal, soon becomes rough and shows a tendency to fall out in places, especially the long hairs around the nose and eyes, though this never progresses to the same extent as it is seen to do in some of the smaller animals. The skin becomes dry and scrawny and sometimes shows eruptions in places, which may

BUREAU OF GOVERNMENT LABORATORIES.

BIOLOGICAL LABORATORY.

ANIMAL RECORD.

Horse No 94

December 7, 1902

Weight 600 lbs. Age 6 yrs Sex Male Color Gray Inoculation Received with trypanosomiasis

History Gray native pony showing symptoms of surra.

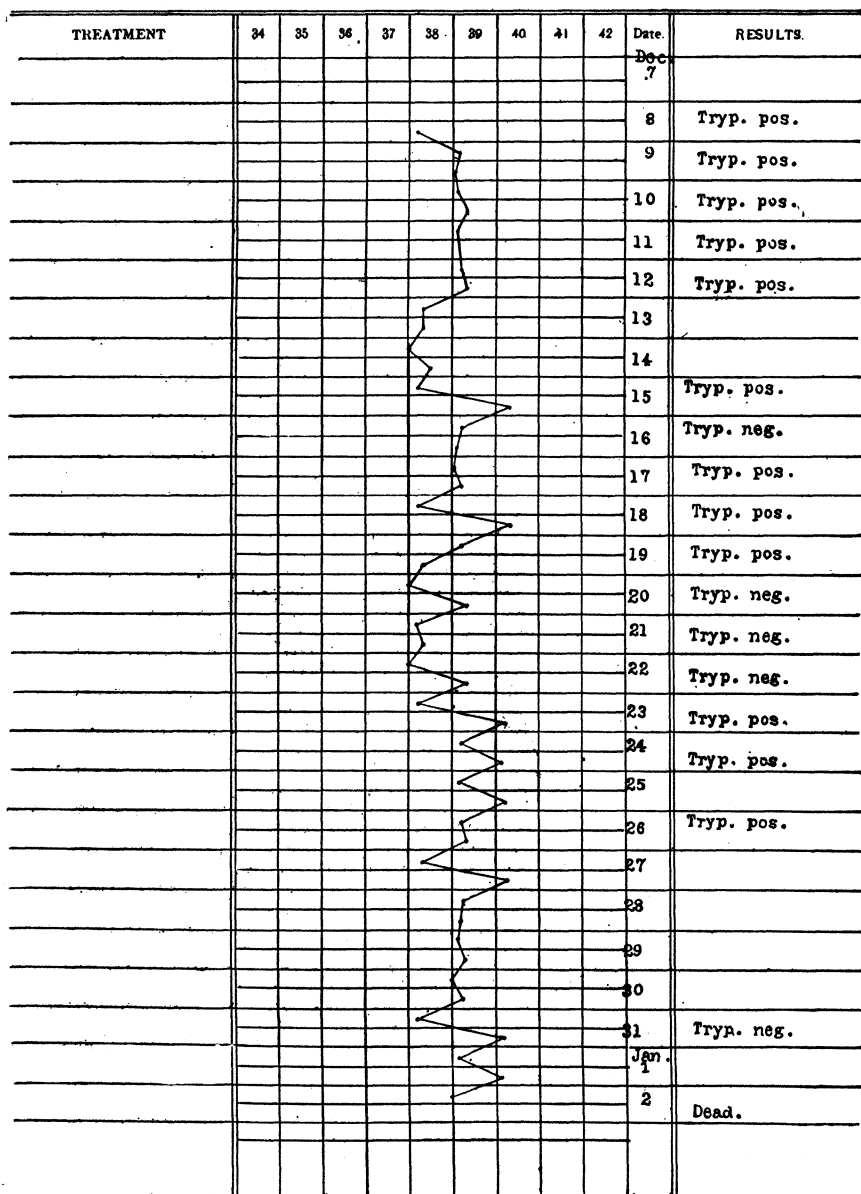


FIG. 117.—Temperature record of surra in a horse.

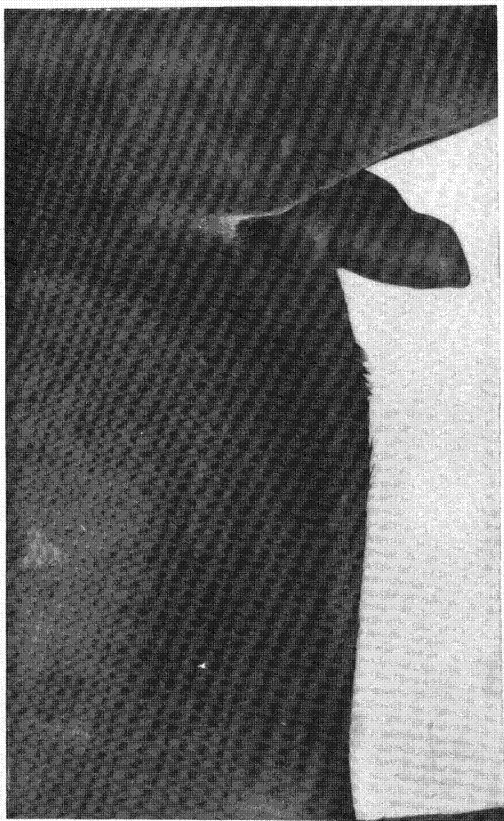


FIG. 120.—SHOWING URTICARIAL ERUPTION AND EDEMA.

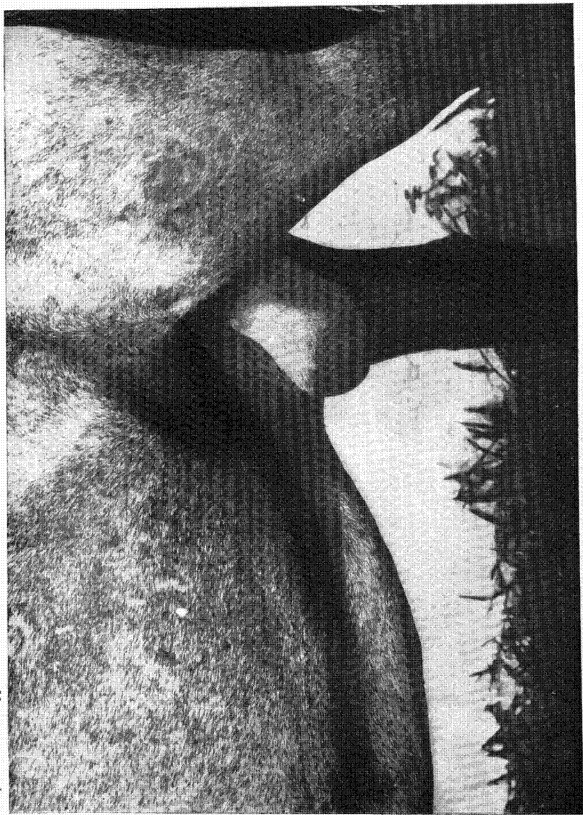


FIG. 121.—SHOWING EDEMA OF SCROTUM AND BELLY.

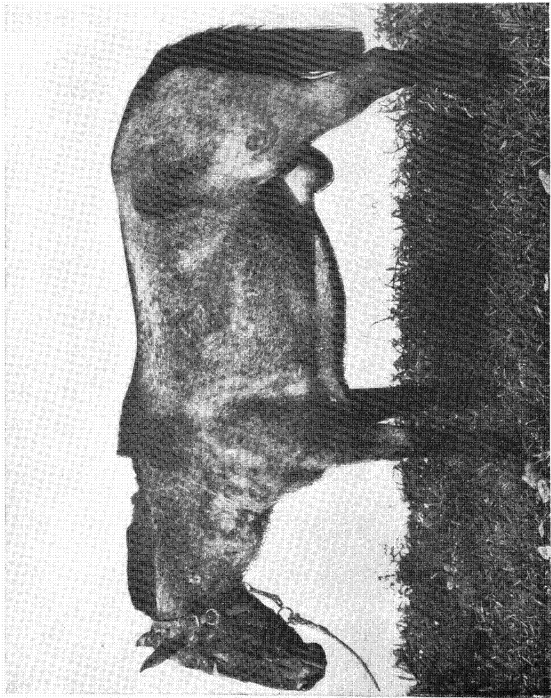


FIG. 122.—NATIVE PONY WITH SURRA, SHOWING EDEMA AND CONDITION OF HAIR.

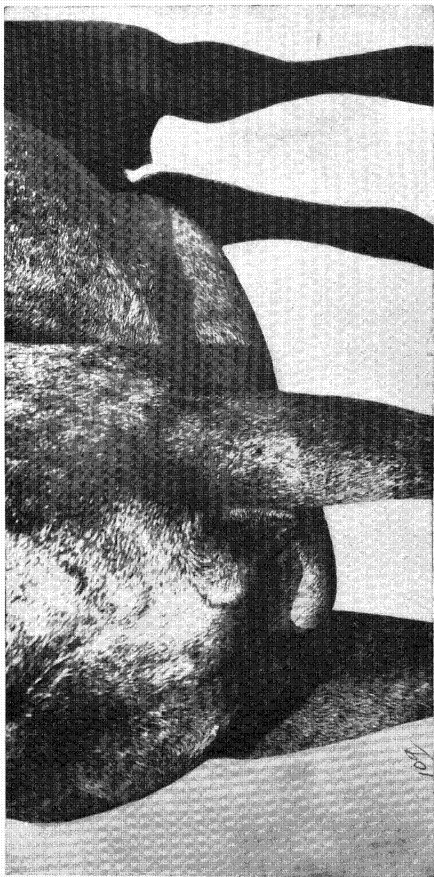


FIG. 123.—SHOWING EDEMA COVERING ABDOMEN AND EXTENDING WELL UP BETWEEN FRONT LEGS; ALSO LARGE PAD ON RIGHT BREAST.

BUREAU OF GOVERNMENT LABORATORIES.
BIOLOGICAL LABORATORY.

ANIMAL RECORD.

Horse No. 840
 April 9, 1903
 Weight Age Sex Color Inoculation Surra
 History Large bay American horse condemned on account of lymphangitis.

TREATMENT.	34	35	36	37	38	39	40	41	42	Days	RESULTS
100 c.c. virulent rinderpest blood sub- cutaneously.										Apr 9	
										10	
										11	
										12	Serum reaction with surra blood negative
										13	
										14	Tryp. neg.
										15	Tryp. neg.
2 c.c. surra blood sub- cutaneously.										16	
										17	
										18	
										19	
										20	Tryp. neg.
										21	Tryp. neg.
										22	
										23	
										24	
										25	
										26	Tryp. surra pos.
										27	
										28	
										29	Tryp. pos.
										30	
										31	Tryp. pos.
										2	
										3	
										4	Tryp. pos.
										5	
										6	
										7	
										8	
										9	
										10	Tryp. neg.
										11	
										12	
										13	Tryp. neg.
										14	
										15	
										16	For tryp.
										17	
										18	
										19	For tryp.
										20	
										21	
										22	
										23	For tryp.
										24	
										25	
										26	
										27	Reaction with horse blood negative.
										28	
										29	
										30	
										31	
										June 1	
										2	Reaction with equal parts of blood sur- ra animal, neg.
										3	do.
										4	do.
										5	do.
										6	
										7	
										8	Very sick. No great enlargement of spleen.
										9	
										10	Humorous tryp.
										11	

FIG. 118.—Temperature record of surra in an American horse.

BUREAU OF GOVERNMENT LABORATORIES.
BIOLOGICAL LABORATORY.

ANIMAL RECORD.

Horse No. 110.

December 17, 1902

Weight _____ Age _____ Sex _____ Color _____ Inoculation surra.

History _____

Native pony early in disease.

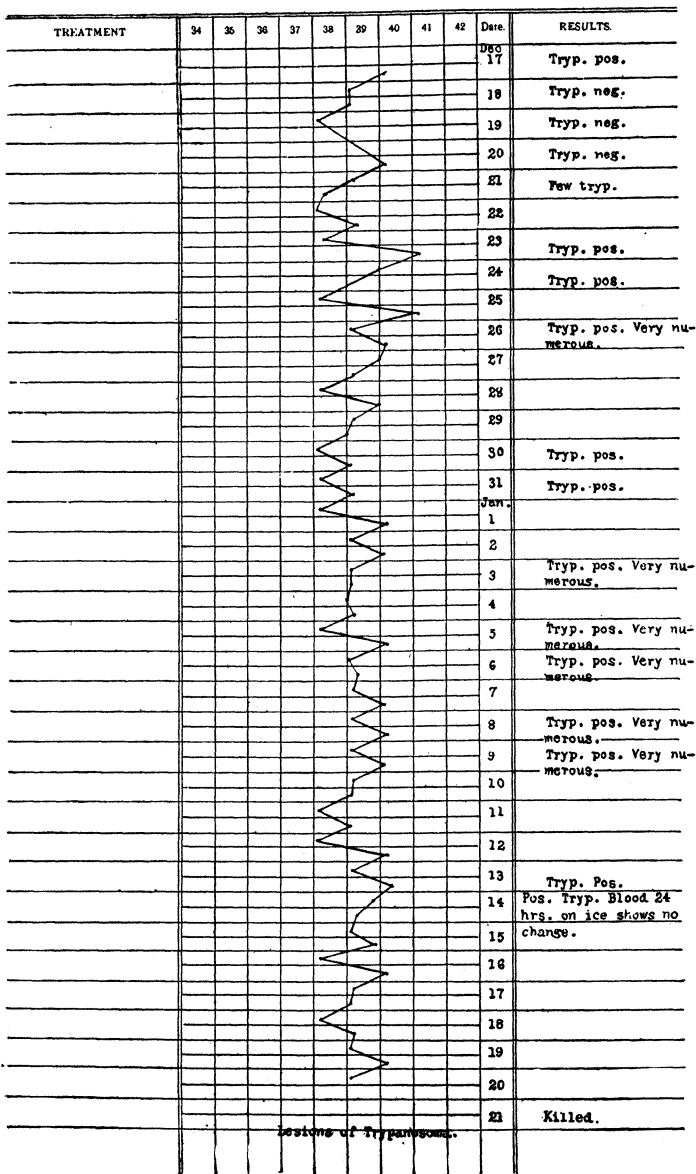


FIG. 119.—Temperature record of surra in a native pony.

be erythematous, macular, or urticarial. We have occasionally noted in well-advanced cases bunches of macules, somewhat concentric in form, which became pustular and finally covered with a scaly exudate caused by the drying of the purulent-looking discharge from the pustules.

Catarrhal symptoms, of the eyes particularly and less noticeable also of the nose, manifest themselves rather early in the disease, although they may come on late and in some cases are almost wholly absent throughout its course. At first the discharge is small in amount and watery, but as the disease progresses becomes more abundant and mucus-like, and finally takes on a yellowish tinge, becomes tenaceous, and often coagulates in the inner canthi of the eyes.

Subcutaneous oedema, more or less marked, is a constant symptom, but varies greatly in the time of its appearance. In some cases it is seen early in the disease, becoming a very prominent symptom, while in others it comes on late and is very insignificant. Its intensity does not appear to bear any relation to the duration of the disease. In nearly every instance it is first noticed around the genitalia (figs. 106, 120), which remain in the majority of cases the most severely involved part. From the sheath it spreads forward along the belly on both sides of the linea alba in two well-defined bands (figs. 107, 121), which may extend between the forelegs, where they then unite and pass on to the chest as a large pad, as illustrated in figures 109, 123. When the swelling becomes marked the two bands under the belly may unite. The oedema extends also down the hind legs, being most marked below the hock. The forelegs may also be involved, but to a less extent. Other places which occasionally show this swelling are the nose and the loose tissues around the eyes, the base of the jaw, the throat, and the base of the ears, but it is rare to see these parts involved to any considerable extent.

One of the earliest symptoms following a rise in temperature is the pallor of the mucous membranes, which first become pearly white and then take on a decided yellowish tinge. In a well-marked case this symptom alone is almost sufficient to make a diagnosis. The mucosa of the mouth, tongue, eyes, and nose assume a ghastly whiteness, which is out of all proportion to the pleural anemia. Before death these membranes become somewhat yellowish, a change which gives a jaundice-like appearance, but is of the same character as that seen in some of the other tissues of the body, and described as a gelatinous infiltration.

Symptoms of the organs of special sense are important. In many cases vision is impaired and total blindness may be brought about, usually by the clouding of the aqueous humor, which in such cases as a rule contains parasites. The sense of hearing is also involved, but generally to a much less extent.

Enlargement of the submaxillary and, to a less degree, of the other subcutaneous glands is a frequent symptom. In some instances the submaxillary glands may be greatly swollen and very sensitive to the touch; and again we have seen animals without any apparent enlargement or tenderness of these organs during the entire course of the disease. When trypanosomiasis is once well established respiration is usually quickened and in many instances more or less labored, as is evidenced by the bellow-like movement of the abdominal walls. These symptoms are intensified whenever broncho-pneumonia complicates the disease.

There are often no gastro-intestinal symptoms of importance, but in most cases a very severe diarrhea develops during the later stages, generally ten or twelve days before death.

The nervous symptoms vary considerably in the horse. In the larger number of cases the described incoordination of movement and the partial paralysis of the hind quarters are present to a certain extent, while cases are met with in which these symptoms do not at any time manifest themselves.

The morbid anatomy has already been considered in the chapter devoted to a general discussion of this subject.

TRYPANOSOMIASIS OF MULES.

Very little in regard to trypanosomiasis of mules is found in literature, excepting the bare statement that these animals are susceptible and have a long period of illness. Voges says that the duration of the disease may be a year or more, but that often the parasites are not found by microscopic examination for days or weeks at a time, and that he would not be surprised at some future time to find an immune animal.

The disease in these animals in the Philippine Islands is of longer duration, just as is true in other infected zones. This fact might be taken advantage of in bettering conditions in countries where surra is prevalent and where means of eradication and prevention are not applicable, because these animals may be used for a long time

without becoming useless through exhaustion incident to the disease. Mules are largely used as draft animals by the military and civil governments of the Philippine Islands and are being introduced to an increasing extent in private enterprises.

By inoculation they are just as susceptible to trypanosomatic infection as horses, but they appear to be less frequently attacked by natural infection; this is no doubt partly owing to the fact that flies disturb them less.

The symptoms in general are similar to those described for the horse; but there are certain slight differences. The temperature is less remittent and more rarely intermittent, and we have not seen a single case in which the fever was of a relapsing type. Edema, weakness, and anemia are slower in their appearance, but when once well established show no suggestive differences.

The parasites, as determined by microscopic examination, as a rule are not so numerous in the peripheral circulation as they are in that of the horse, and the periods during which they are not found at all are more frequent and of longer duration. However, just as in horses, the blood is constantly infectious by inoculation throughout the course of the disease. The incubation period is the same as in the horse, the duration from four to twelve weeks or even longer, and the mortality 100 per cent.

As a general rule skin lesions are more constant and decided than in the case of the horse, although of the same general character. The localization of symptoms in the skin and genitals is more noticeable in animals showing some resistance to the infection than in others, so that in some of the lower animals—such as the rabbit—we have a very satisfactory clinical picture of dourine.

The morbid anatomy in mules is very similar to that of the horse, which has already been discussed.

TRYPANOSOMIASIS OF ASSES.

According to Laveran and Mesnil, nagana shows the same general character of infection in these animals as it does in the horse. The course of the temperature is more irregular, and the relation of the number of parasites in the peripheral circulation to the temperature is more constant. As a rule, they are less numerous in the blood and may be entirely absent for longer periods of time. The local symptoms, particularly edema, are said to be scarcely noticeable in these animals. The average duration of the disease is given by these authors as fifteen days.

Voges states that asses are invariably susceptible to mal de caderas, and that the symptoms of the disease in them do not differ from those described for mules. Koch found the asses of Massai immune to the infection. He does not appear, however, to have demonstrated the immunity of these animals by inoculation; and as all other writers, referring to the susceptibility of the various species of asses, have always found them to be capable of contracting the disease, we can not but feel sceptical about Koch's conclusions. Lingard mentions particularly the chronic course of surra in the donkey. There are no asses in the Philippines, so that we have been unable to perform any work on these animals.

TRYPANOSOMIASIS OF OTHER EQUIDES.

All other equides, including hybrids, have been shown to be susceptible by various writers, although very little on the course of the disease in these animals is given in detail. As they are not of any economic importance in these islands, no consideration will be given them here.

TRYPANOSOMIASIS OF CATTLE.

The great variations in results obtained in the study of this family of animals and their undoubted great importance in perpetuating epidemics make it one of the most important to be considered. In nearly all countries where the infection is prevalent cattle have been found to be susceptible.

With reference to the course of trypanosomiasis in cattle and the mortality of these animals, there is wide difference of opinion in the same country, as well as in different ones. So far as we know, Voges, in South America, is the only writer who states positively that some cattle are not susceptible. He is certain the cattle of that country do not contract the disease after being inoculated.

Certain writers in Africa maintain that cattle are very susceptible to nagana, with a high mortality. Others, as Schilling, have shown the infection not to be invariably virulent for these animals, the course of the disease to be long, and the mortality low, some cases of complete recovery being reported. Laveran and Mesnil, working with *Trypanosoma* of nagana in France, obtained a long course of the disease in

RAT SURRA

Chart I.

RECORDS OF TEMPERATURE, PULSE AND RESPIRATION.

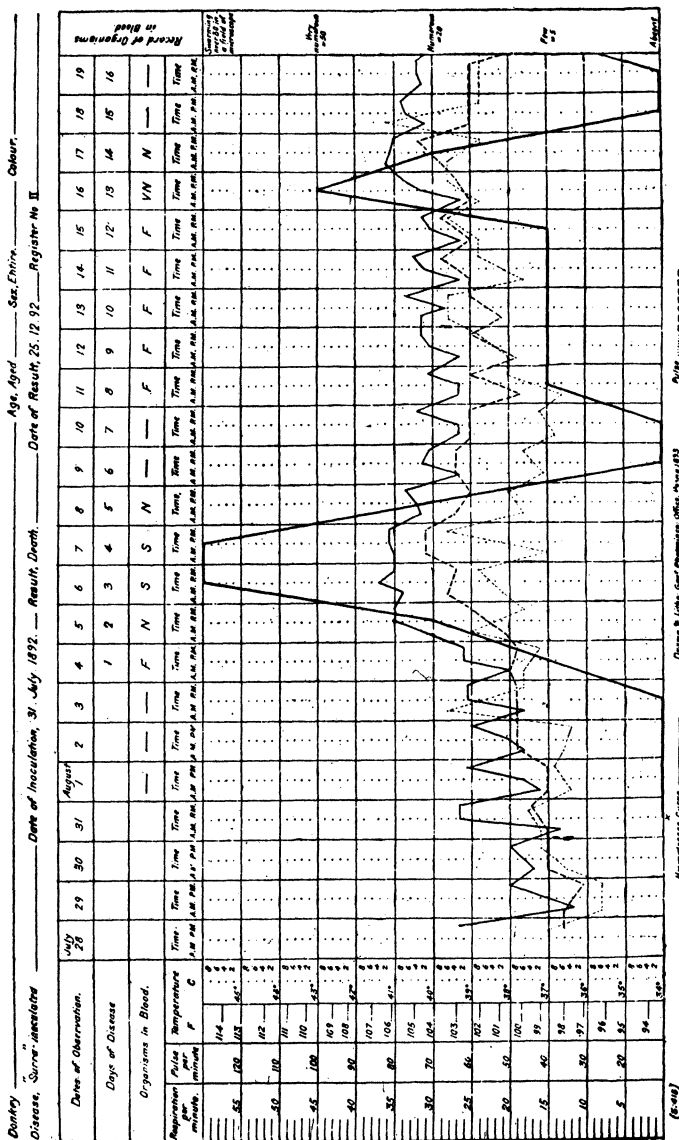
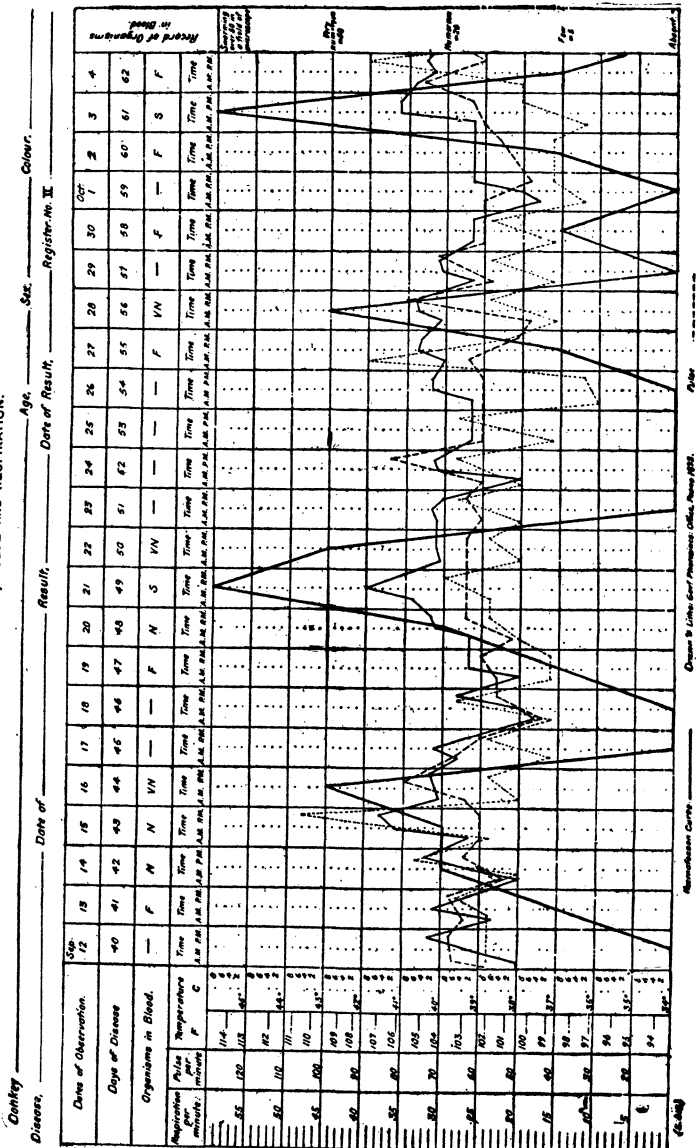


Chart III.

RAT SURRA

45

RECORDS OF TEMPERATURE, PULSE AND RESPIRATION.



RAT SURRA

Chart IV

RECORDS OF TEMPERATURE, PULSE AND RESPIRATION

Donkey Disease. Date of _____ Result _____ Date of Result _____ Sex _____ Age _____ Colour _____

Register No. II

Oct 5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Days of Observation																						
Days of Disease																						
Organisms in Blood.																						
Respiration per minute																						
Pulse per minute																						
Temperature °F																						
Record of Organisms in Blood																						

100% Time
 50% Time
 25% Time
 12.5% Time
 6.25% Time
 3.125% Time
 1.5625% Time
 0.78125% Time
 0.390625% Time
 0.1953125% Time
 0.09765625% Time
 0.048828125% Time
 0.0244140625% Time
 0.01220703125% Time
 0.006103515625% Time
 0.0030517578125% Time
 0.00152587890625% Time
 0.000762939453125% Time
 0.0003814697265625% Time
 0.00019073486328125% Time
 0.000095367431640625% Time
 0.0000476837158203125% Time
 0.00002384185791015625% Time
 0.000011920928955078125% Time
 0.0000059604644775390625% Time
 0.00000298023223876953125% Time
 0.000001490116119384765625% Time
 0.0000007450580596923828125% Time
 0.00000037252902984619140625% Time
 0.000000186264514923095703125% Time
 0.0000000931322574615478515625% Time
 0.00000004656612873077392578125% Time
 0.000000023283064365386962890625% Time
 0.0000000116415321826934814453125% Time
 0.00000000582076609134674072265625% Time
 0.000000002910383045673370361328125% Time
 0.0000000014551915228366851806640625% Time
 0.00000000072759576141834259033203125% Time
 0.000000000363797880709171295166015625% Time
 0.0000000001818989403545856475830078125% Time
 0.00000000009094947017729282379150390625% Time
 0.000000000045474735088646111895751953125% Time
 0.0000000000227373675443230559478759765625% Time
 0.00000000001136868377216152797393798828125% Time
 0.000000000005684341886080763986968994140625% Time
 0.000000000002842170943040381993484497072265625% Time
 0.0000000000014210854715201909967422485361328125% Time
 0.00000000000071054273576009549837112426806640625% Time
 0.000000000000355271367880047749185562134033203125% Time
 0.0000000000001776356839400238745927810670166015625% Time
 0.0000000000000888178419700119372963905335033203125% Time
 0.00000000000004440892098500596864819526675166015625% Time
 0.000000000000022204460492502984324097633375830078125% Time
 0.0000000000000111022302462514921620488166875830078125% Time
 0.00000000000000555111512312571008102444403375830078125% Time
 0.000000000000002775557561562554900512222016875830078125% Time
 0.000000000000001387778780781277450256111100839375830078125% Time
 0.0000000000000006938893903906387251280555504004196875830078125% Time
 0.00000000000000034694469519531936256402777520020984375830078125% Time
 0.000000000000000173472347597659681282013886100104921875830078125% Time
 0.00000000000000008673617379882984064100693055000524609375830078125% Time
 0.000000000000000043368086899414920320503465275002623046875830078125% Time
 0.000000000000000021684043449707460160251732637500131115234375830078125% Time
 0.00000000000000001084202172485373008012508663187500065576196875830078125% Time
 0.00000000000000000542101086242686504006250433159375000327880984375830078125% Time
 0.0000000000000000027105054312134325200312502165968750001639404921875830078125% Time
 0.0000000000000000013552527156067162600156250108298437500008197024609375830078125% Time
 0.0000000000000000006776263578033581300078125005414921875000040985123046875830078125% Time
 0.00000000000000000033881317890167906500390625002707460937500002049256196875830078125% Time
 0.00000000000000000016940658945083953250195312500135373046875000010246280984375830078125% Time
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 0.0000000000000000000211758236813549441562500244140625000169216308593750000012807855123046875830078125% Time
 0.00000000000000000001058791184067722078125001220703125000084608154296875000000640392756196875830078125% Time
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 0.000000000000000000002646977

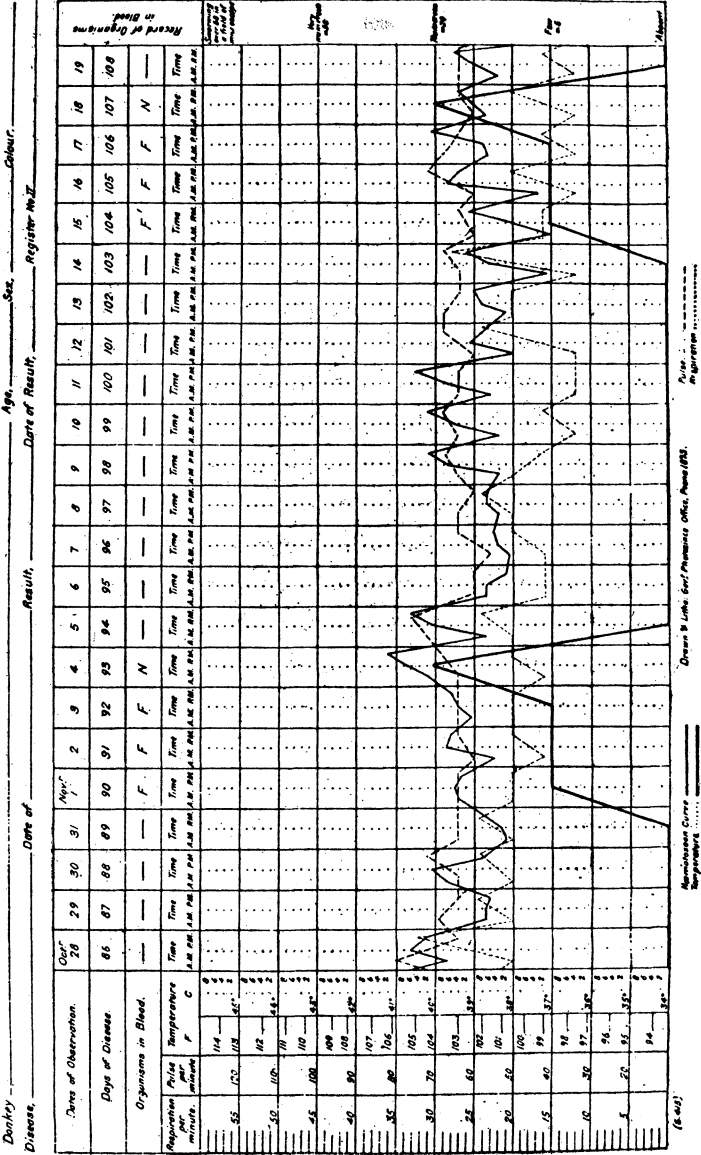
FIG. 125—Continued.

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RAT SURRA

Chart V.

RECORDS OF TEMPERATURE, PULSE AND RESPIRATION



RECORDS OF TEMPERATURE, PULSE AND RESPIRATION.

Bull _____ Age, years _____ Sex _____ Colour _____
Disease, "Kat Surra" through several animals Date of inoculation, 31.7.1932 Result _____ Date of Result _____ Register No. III.

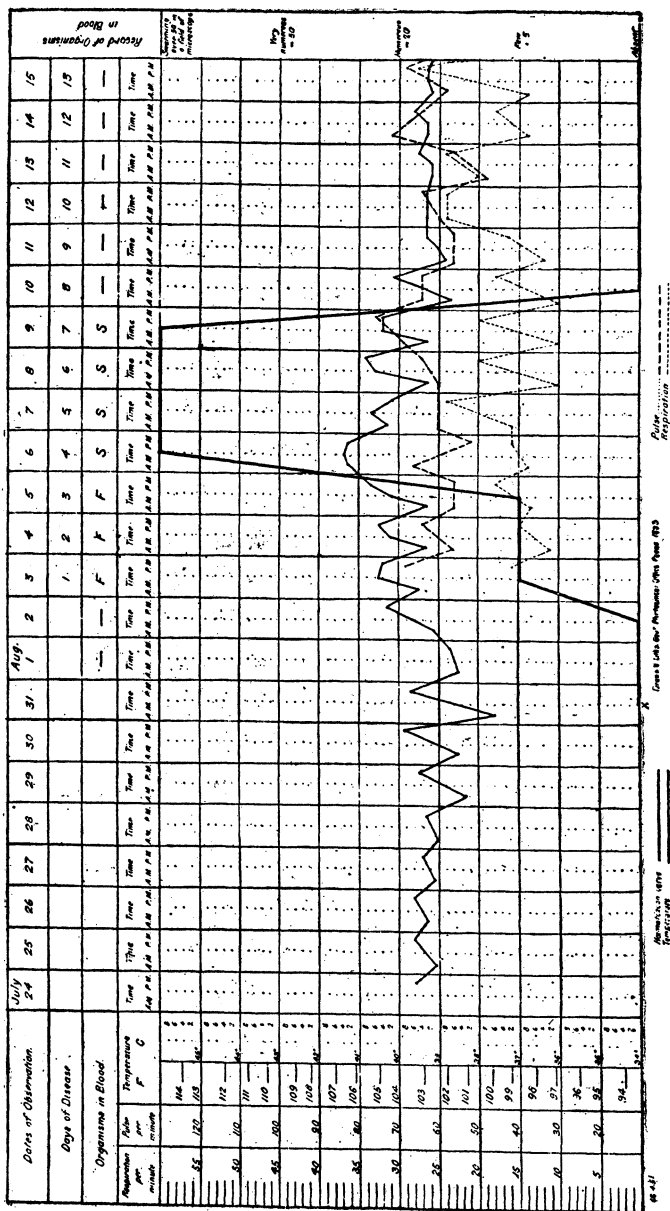


FIG. 126.—Temperature record of surra in a bull. (After Lingard.)

Chart IV.

RECORDS OF TEMPERATURE, PULSE AND RESPIRATION

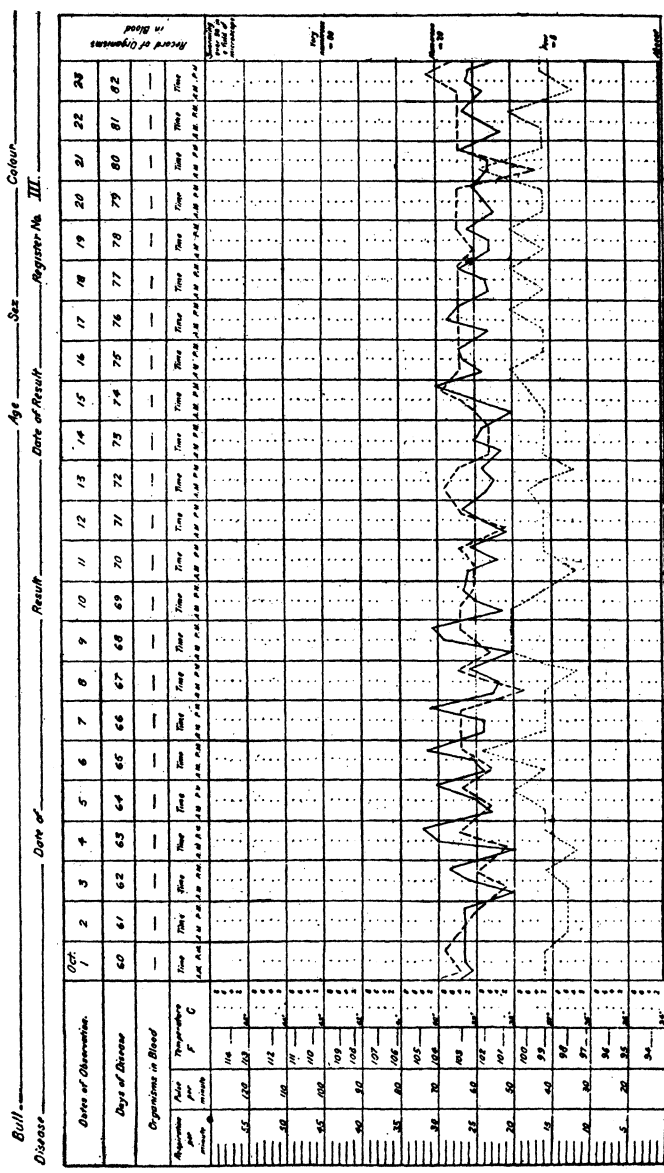


Chart IV. Records of Temperature, Pulse and Respiration. Fig. 126.—Continued.

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RAT SURRA

Chart VI

RECORDS OF TEMPERATURE, PULSE AND RESPIRATION.

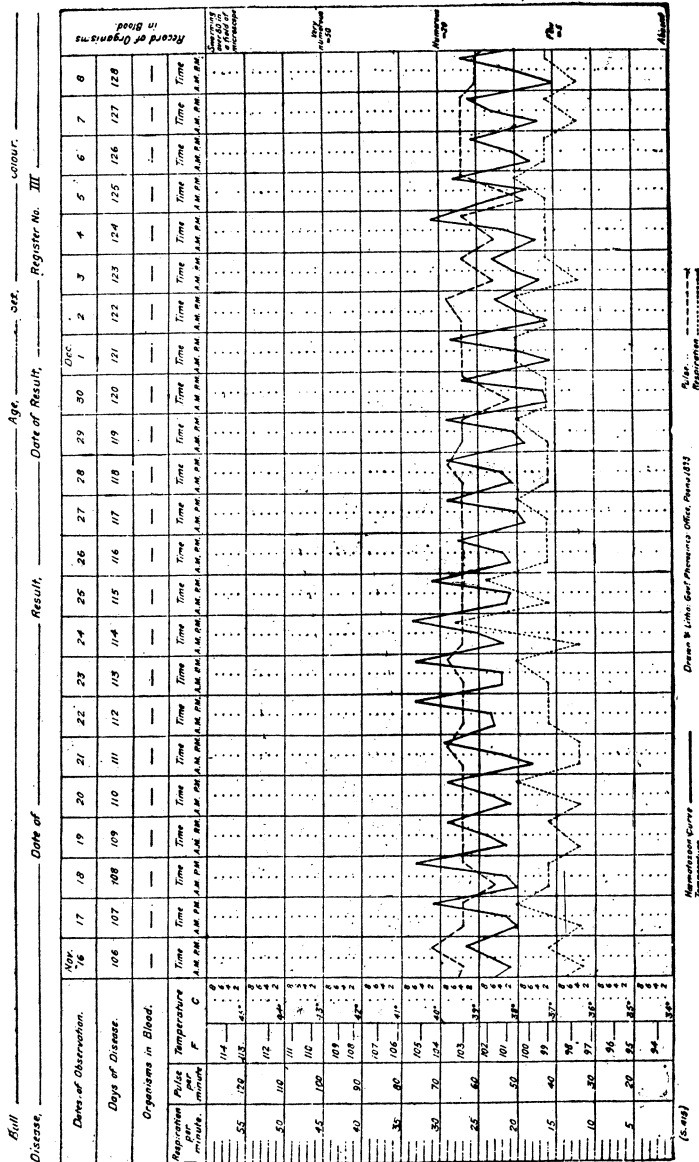
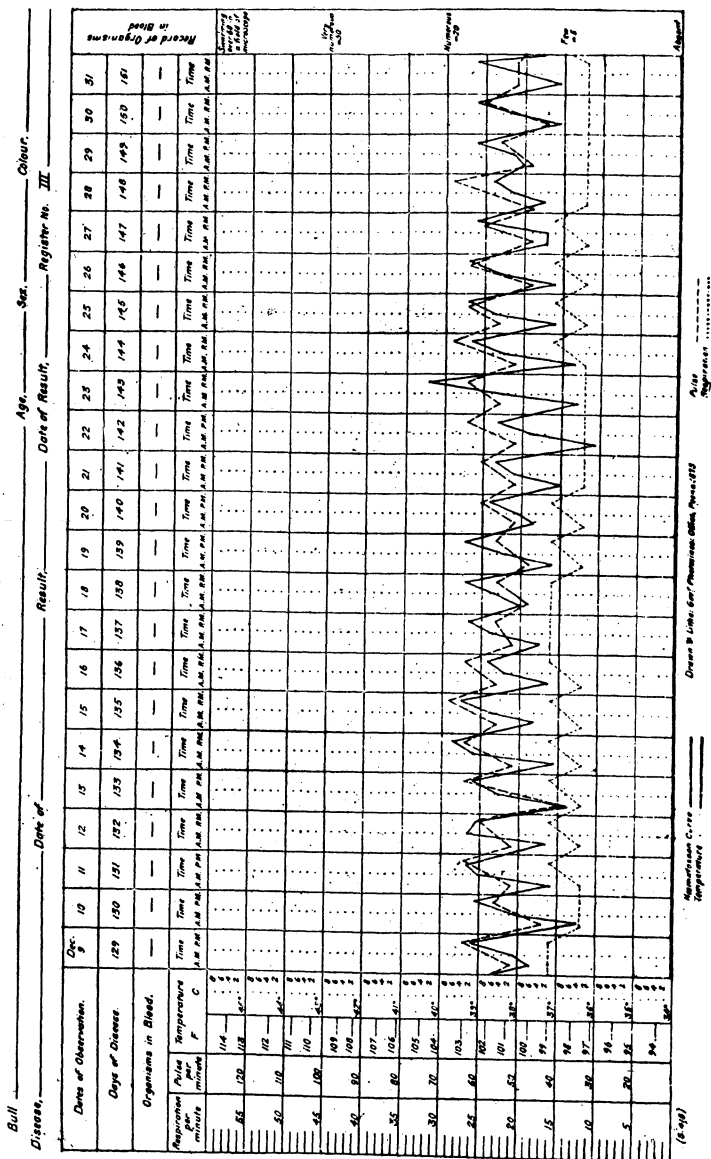


Fig. 126—Continued.

RAT SURRA

Chart VII

RECORDS OF TEMPERATURE, PULSE AND RESPIRATION.



BUREAU OF GOVERNMENT LABORATORIES.
BIOLOGICAL LABORATORY.

ANIMAL RECORD.

Cow No. 280June 1, 190³Weight 500 lbs. Age 8 yrs. Sex Male Color Red Inoculation Surra.History Rinderpest serum animal under observation for several months.

TREATMENT.	34	35	36	37	38	39	40	41	42	Date.	RESULTS.
										June 1	
1500 c.c. bleed of										2	
cow suffering from										3	
surra.										4	
										5	
										6	
										7	
										8	
										9	
										10	
										11	
										12	
										13	
										14	
										15	Tryp. neg.
										16	Tryp. neg.
										17	Tryp. neg. Monkey
										18	given 1 c.c. blood
										19	Tryp. neg.
										20	Tryp. neg.
										21	Tryp. neg.
										22	Tryp. neg.
										23	
										24	

FIG. 127.—Surra in cow with very rapid course.

BUREAU OF GOVERNMENT LABORATORIES.
BIOLOGICAL LABORATORY.

ANIMAL RECORD.

Bull No 283.

May 15, 1903

Weight _____ Age _____ Sex _____ Color _____ Inoculation _____ animals

History _____

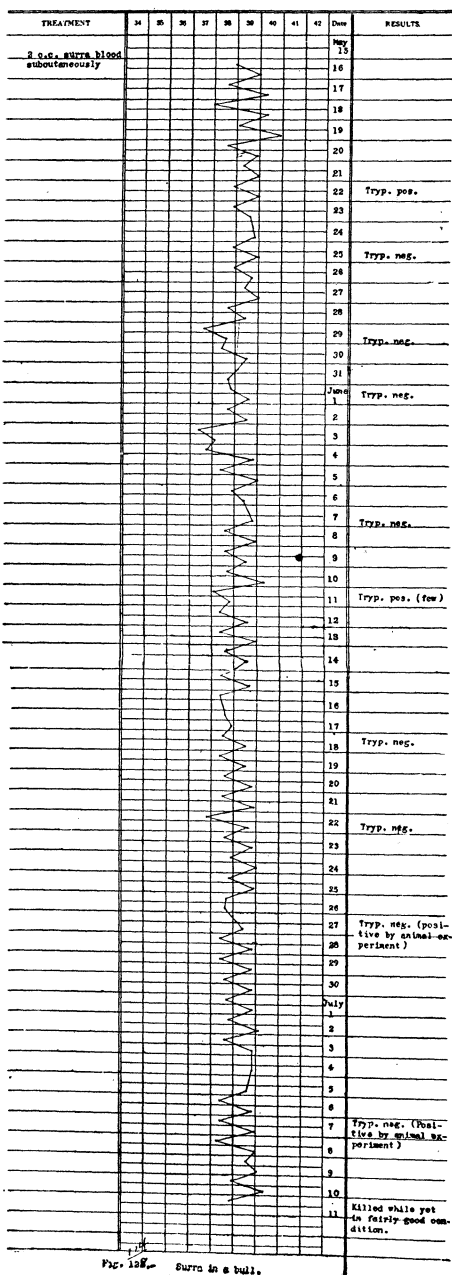


FIG. 128.—Surra in a bull.

FIG. 128.—Surra in a bull.

infected animals, and the mortality was certainly much lower than the reports usually received from Africa would indicate for that country. Writers in India practically all agree that cattle are susceptible to the disease, but mention its long course, lower mortality, and some cases of complete recovery.

Bruce states that the duration of nagana varies from a week to six months or more. The symptoms are much less marked than in horses or dogs. Emaciation is rapid; the hair becomes rough and falls out; fluid runs from the nose and eyes, and there is a tendency to diarrhea. The dewlap becomes edematous, but the edema is not so prominent on the abdomen and posterior extremities as in the

BUREAU OF GOVERNMENT LABORATORIES.
BIOLOGICAL LABORATORY.

ANIMAL RECORD.

Monkey No. 49

September 11, 1902

Weight _____ Age _____ Sex _____ Color _____ Inoculation Trypanosoma

History Medium-sized monkey, in healthy condition.

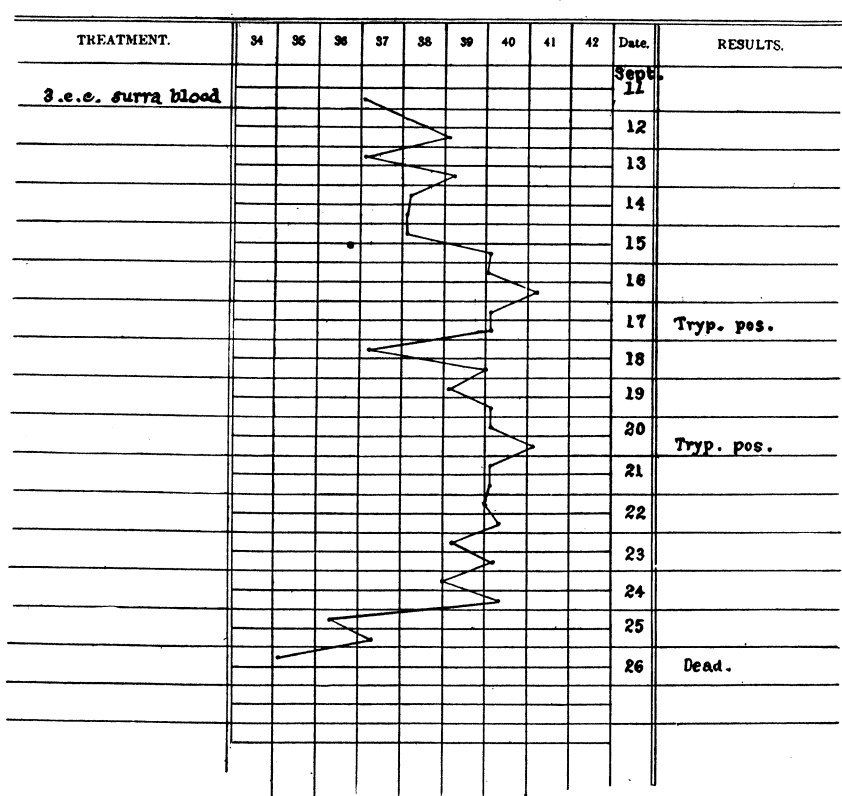


FIG. 129.—Temperature record of surra in a monkey.

infection of the horse. Fever is constant, but not so high as in the case of horses, occasionally reaching 41° C. Parasites are rare in the blood.

Schat, working with the surra of Java, maintains that the disease is very virulent in that country for these animals, stating that the mortality is enormous, the infection sometimes being acute and of short duration, and at others chronic with a longer course. However, as already stated, from Schat's description of the disease we can not but believe that there was some other element present to complicate his

cases. He unquestionably worked with trypanosomiasis and *Trypanosoma* were no doubt present, but his description of the symptomatology and the morbid lesions greatly resembles those of rinderpest. It seems more than likely that he was working with a combination of these two diseases.

Theiler observed in the cattle of South Africa an acute pernicious anemia with only slight fever, which he considered due to a special *Trypanosoma* named by Laveran and Mesnil *Trypanosoma theileri*.

Lingard speaks particularly of recurrent transient urticarial eruptions in cattle suffering from surra. Great variations were observed in the temperature, the remissions always being observed in the mornings. Emaciation was usually marked. Parasites were few and intermittently present in the peripheral circulation. He gives the usual incubation period in inoculated cases as four to eleven days, and states that the course is chronic, with no mortality in uncomplicated cases.

In the Philippines very little has been written about this disease in cattle, except that they are susceptible. In our work, which has now covered a period of nearly one year, we have examined the blood of hundreds of animals, and but few cases of natural infection have been found. It may be that during the wet season a large number of these animals suffer from trypanosomiasis. By inoculation they are susceptible, and the course of the disease as well as its symptomatology correspond to the descriptions given by the best authors in other countries.

The incubation period is about the same as in the horse, and the other symptoms begin in very much the same manner. The temperature (figs. 113, 127, 114, 128), as a rule, is less intermittent than in the horse, and does not run so high. No relation can be established between the temperature and the number of parasites. *Trypanosoma* in sufficient numbers to be detected by the usual microscopic examination are intermittently present in the blood, but the latter, as in other animals, is constantly infectious by animal experiment. The appetite usually remains good, but there are transient periods of anorexia in almost all cases, and some animals refuse food for days at a time. The bowels remain normal or show a tendency to constipation.

Emaciation is rapid, and as a rule begins earlier than in the horse. Anemia, as shown by the pallor of the mucous membranes, is probably less marked than in the horse. The catarrhal symptoms of the nose and eyes are slight in most animals, but in those cases which prove fatal may become a prominent symptom. Edema is decidedly less marked than in the horse, and in some animals is scarcely perceptible, while in others it appears particularly in the dewlap and less so on the abdomen and hind legs. The hair becomes rough and in places falls out. Urticarial eruptions are quite frequent.

On the whole, the picture is similar to that seen in other animals, and in well-advanced cases a diagnosis should be easy. Owing to the scarcity of parasites in the circulating blood and their apparent intermissions, the laboratory diagnosis of these animals should include animal experiment.

The course of the disease is usually chronic, and in animals observed here the mortality is low. In some cases the disease may be very acute; one of our inoculated animals, for example, lived only twenty-four days (fig. 127). We have not been able to examine a sufficiently large number of cases, and for that reason do not desire to give definite figures as to the mortality.

Several varieties of cattle are found in the Philippine Islands in addition to the native ones, these including Australian, Chinese, American, Straits Settlement, and Javanese.

TRYPANOSOMIASIS OF CARABAO.

The Indian buffalo, of which the so-called carabao of the Philippine Islands is a species, has been proved susceptible to surra by Lingard.

The course of the disease in his animals very closely resembled that of the cow. The incubation period was about five days in inoculated animals, and the duration in two of his animals was forty-six and one hundred and twenty days, respectively, followed in each case by death. According to his description there were very distinct exacerbations and remissions of temperature in both cases. The appetite remained good, but emaciation was marked and progressive. Nothing of especial interest was noted at post-mortem examination.

Curry mentions trypanosomiasis of carabaos in the Philippine Islands, but does not give any data of importance.

TRYPANOSOMIASIS OF MONKEYS.

Monkeys, where available, are among the most valuable animals for the study of trypanosomiasis. They are seldom naturally infected, but are very susceptible to inoculation, and run a regular course.

Kanthuck, Durham, and Blandford inoculated a monkey with *Tr. brucei*. During the two weeks of its illness parasites were constantly present. The post-mortem examination showed advanced pulmonary tuberculosis.

Nocard subcutaneously inoculated an old monkey with several drops of blood from a nagana mouse. He gives the incubation period as four days and the duration of the disease as fifteen days. Parasites were very numerous throughout its course and at the time of death exceeded the red-blood cells in number. The principal symptoms were high temperature, œdema of the eyelids and pockets, and dejection of spirit.

Sivori and Lecler give the incubation period in "*surra americana*" as three days, followed by death about the sixth day. The temperature is high at first, and just before death drops to 36° C. Anemia is rapid and progressive. The appetite remains good. Toward the end there is some drowsiness, followed by death in coma. The post-mortem examination shows an enlarged spleen with dark-red pulp, œdema of the lungs, and a small quantity of citrin liquid in the serous sacs.

Voges says that a monkey (*Nictipitechus felinus*) inoculated with *Tr. equinum* succumbed to the disease. Several observers in India have shown monkeys to be susceptible by inoculation to the surra of that country; they have also been proved capable of contracting dourine.

Monkeys have been extensively used in our work, and the following statements are based upon the clinical and post-mortem study of a large number of these animals. In the course of this investigation the blood of hundreds of monkeys from all parts of the islands, from infected areas and from those not infected, has been examined, and only once has a naturally infected animal been found, although they are very susceptible to the disease, which, when given by inoculation, invariably proves fatal.

The incubation period in these animals varies with the manner of inoculation, being on the average one to three days by subcutaneous or scratch inoculation, whether by syringe or insect, and somewhat shorter by intra-abdominal inoculation. The duration is from five to thirty-five days and the mortality 100 per cent.

Monkeys are the only animals that show undoubted evidence of having pain caused by the infection. The manner in which for hours at a time they hold their heads between their hands leaves little doubt but that they suffer from headache.

The character of the fever varies considerably (figs. 115-118, 129-132). It is generally intermittent or markedly remittent, and always higher in the afternoons. In some cases it may be nearly continuous, especially in the later stages of the disease. Just before death there may be hyperpyrexia and the temperature may fall to subnormal, although death may occur without either of these changes.

Parasites may as a rule be found by microscopic examination throughout the course of the disease. In not a few cases, however, there are intermissions of short duration; and in one case we found parasites only once in daily examinations for seven days, though the blood was infectious by animal experiment during this time.

œdema as a rule is not a prominent symptom, but is sometimes noticeable about the face and genitals. Anemia is rapid and severe, but the emaciation is not so great as that observed in other animals. Some interference with the gait is occasionally noticed, but it is neither constant nor very severe. Gastro-intestinal changes are absent in most cases, but diarrhea is sometimes noticed toward the end.

Necropsy shows the general lesions seen in other animals. In addition to the evidence of severe anemia, the most constant changes are an enlarged, mottled spleen, enlarged lymphatics, fluid in the serous cavities, and flakes of fibrin over the surfaces of the organs.

TRYPANOSOMIASIS OF DOGS.

Dogs are susceptible to surra in India and show the same general symptoms as those seen in other animals. The incubation period is short and the course rapid.

Lingard mentions as the principal symptoms paroxysmal fever (figs. 119, 133), anorexia, later a swelling of the skin about the head and throat, injection of the conjunctiva, increased lachrymation, in some cases effusions into the joints, marked œdema of the limbs and the belly, extravasation of the blood into the anterior chambers, opacity of the cornea, and later total blindness. He gives as the principal anatomic lesions subpleural extravasations and sometimes localized consolidation of the lungs, enlarged spleen and kidneys, with subcapsular petechiæ.

Rouget proved dogs susceptible to dourine. The symptoms were œdema, particularly marked in the genitals, paralysis of the hind quarters, and conjunctivitis, sometimes followed by keratitis.

Dogs, according to Voges, contract mal de caderas by eating the flesh of animals dead of the disease, not, however, through the sound mucosa, but through injuries,

BUREAU OF GOVERNMENT LABORATORIES.
BIOLOGICAL LABORATORY.

ANIMAL RECORD.

Monkey No 66October 21 1902Weight _____ Age _____ Sex _____ Color _____ Inoculation Trypanosoma

History _____

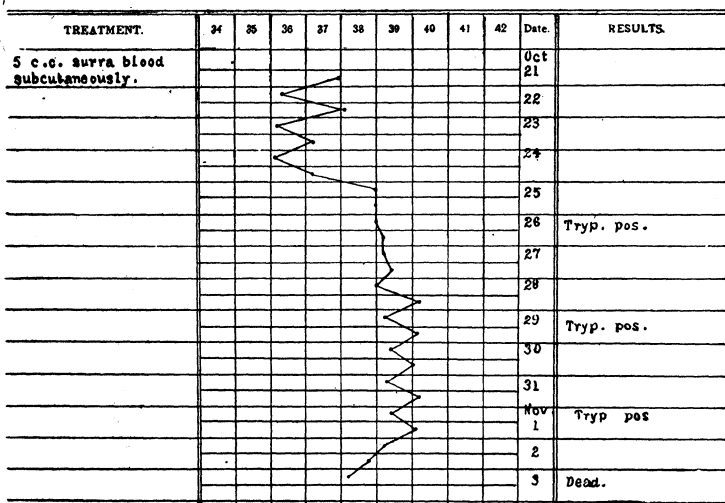


FIG. 130.—Temperature record of surra in a monkey.

BUREAU OF GOVERNMENT LABORATORIES.
BIOLOGICAL LABORATORY.

ANIMAL RECORD.

Monkey No 18March 5, 1902Weight _____ Age _____ Sex _____ Color _____ Inoculation Trypanosoma

History _____

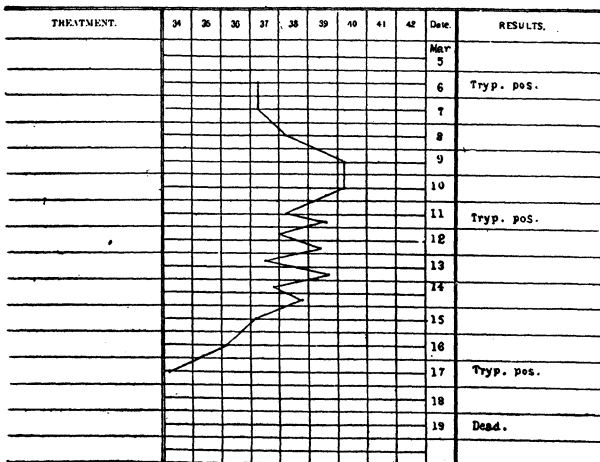


FIG. 131.—Temperature record of surra in a monkey.

BUREAU OF GOVERNMENT LABORATORIES.
BIOLOGICAL LABORATORY.

ANIMAL RECORD.

Monkey No 137

January 16, 1903

Weight Medium, Age _____ Sex Male Color _____ Inoculation Tryp. from rat.

History — Healthy animal under observation for one month.

TREATMENT	34	35	36	37	38	39	40	41	42	Date.	RESULTS
3 c.c. blood from rat.										Jan 17	
										18	
										19	
										20	Tryp. pos.
										21	
										22	Tryp. pos.
										23	
										24	
										25	
										26	
										27	Edema of face
										28	
										29	
										30	Tryp. pos.
										31	
										Feb 1	
										2	
										3	
										4	
										5	
										6	
										7	
										8	
										9	
										10	Very ill.
										11	Dead,

FIG. 182.—Temperature record of surra in a monkey

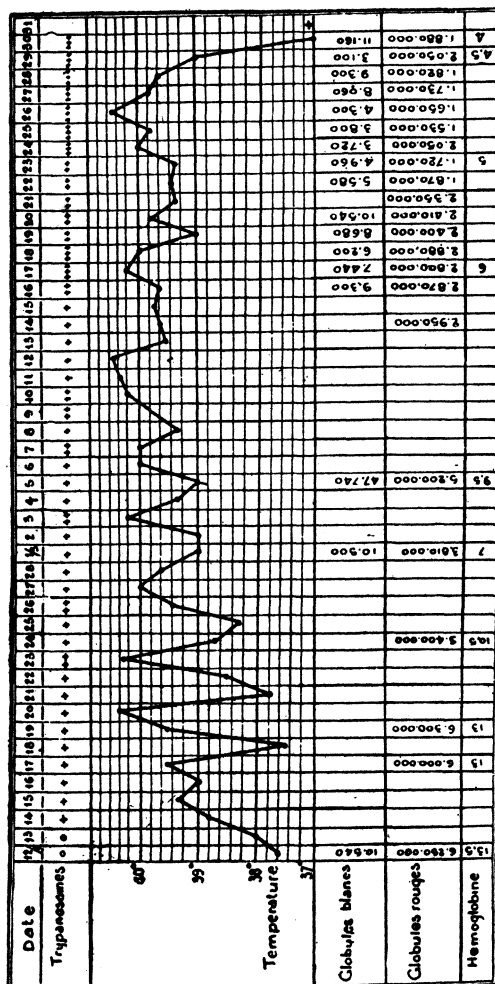


Fig. 134.—Temperature record of dog inoculated February 12, 1902, intravenously with $\frac{1}{4}$ c. c. of rat's blood very rich in Trypanosoma. Dead in 48 days. (After Lignieres, in Recueil d. Med. Vet. Vol. 10, No. 4, Feb. 28, 1903, p. 131.)

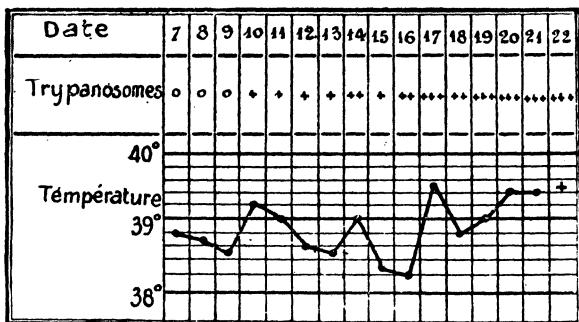


FIG. 135.—Temperature record of surra in a dog. Inoculated on January 6, 1901, subcutaneously with $1\frac{1}{2}$ c. c. of blood from Dog No. 2, containing from 3 to 4 parasites in the microscopic field. Dead in 16 days. (After Lignieres, in Recueil d. Med. Vet. Vol. 10, No. 4, February 28, 1903, p. 130.)

BUREAU OF GOVERNMENT LABORATORIES.
BIOLOGICAL LABORATORY.

ANIMAL RECORD.

Dog: No—206—
March 20, 1903

Weight— Age— Sex— Color— Inoculation Tr. Evansi
History—

TREATMENT.	34	35	36	37	38	39	40	41	42	Date.	RESULTS.
2 c.c. surra blood subcutaneously										Mar 20	
										21	
										22	
										23	
										24	Tryp. pos.
										25	
										26	Numerous tryp.
										27	
										28	Dead.

FIG. 136.—Temperature record of surra in a dog.

BUREAU OF GOVERNMENT LABORATORIES.
BIOLOGICAL LABORATORY.

ANIMAL RECORD.

Dog No 99
December 11, 190³

Weight Age Sex M Color Inoculation Trypanosoma.

History Dog under observation one week.

TREATMENT.	34	35	36	37	38	39	40	41	42	Date.	RESULTS.
										Dec. 11	
										12	
										13	
1 c.c. trypanosoma blood.										14	
										15	
										16	Tryp. pos.
										17	Tryp. pos.
										18	Tryp. pos.
										19	Tryp. pos.
										20	
										21	
										22	
										23	Tryp. pos.
										24	
										25	Tryp. pos. Very numerous.
										26	Dead.

FIG. 137.—Temperature record of surra in a dog.

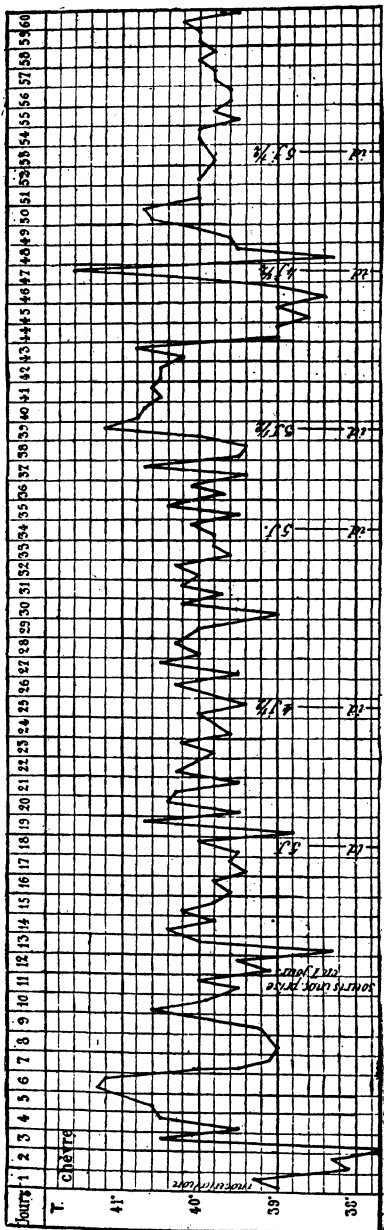


Fig. 139.—Nagana in a goat. (After Laveran and Mesnil, 1902, fig. 5.)

which are always found to be present on examination and are caused by fighting. The incubation period is short and the duration of the illness varies from two to three months.

He describes the symptoms as follows:

"The animal becomes stupid, emaciates, no longer responds when called, sleeps, hides in dark corners, and its head becomes swollen (bulldog appearance) as a result of the oedema, which affects particularly the eyelids. The conjunctiva are involved to a pitiful extent and secretions similar to those seen in the rabbit are observed. The hair about the eyes falls out. The vision is likewise impaired by the chronic conjunctivitis. There is marked oedema of the scrotum, which is first revealed by the swelling of the testicles. * * * The penis is not involved. On section enlarged spleen and serous exudates are observed. * * * There are days when *Trypanosoma* are not found in the blood."

Nagana, according to Bruce, has a rapid course in these animals (eight to sixteen days) and is invariably fatal. He mentions as the principal symptoms continuous fever (rarely intermittent) with elevations to 40° and 41° C., extreme emaciation, pustular eruptions near the extremities, and a milky aspect of the cornea.

Kanthuck, Durham, and Blandford give the period of incubation as from four to six days and the average duration of the disease as eighteen days. Fever is a constant symptom, the temperature becoming subnormal near death. Oedema is common and more marked about the head, legs, belly, and genitalia. Turbidity of the aqueous humor, fibrinous plaques in the anterior chamber, and corneal opacities are occasionally seen. Corneal ulcers and conjunctivitis are frequently associated with the oedema of the eyelids and face. Parasites may be absent from the blood from four to six days, but continue to increase in number and before death may reach 100,000 to 300,000 per cubic millimeter. Terminal bacterial infections are apt to occur in these animals, thus accelerating death.

Anatomically muscular wasting is well marked, but the fatty tissues are less affected, except at the base of the heart, where the fat may undergo oedematous degeneration. Lymphatic hyperplasia is well marked, the glands being congested or hemorrhagic. The spleen is enlarged, granular, firm, and friable. Serous effusions and subserous hemorrhages are present.

Laveran and Mesnil state that the virus was frequently more active in their experience than in that of others. Their dogs lived from six and one-half to twelve days. The incubation period from subcutaneous inoculation varied between two and four days. Parasites could always be demonstrated to be present in the blood by microscopic examination, and from the time of their first appearance until death they usually increased in number; but in the dogs which lived for twelve days there were remissions on the eighth and ninth days, followed by augmentation. Parasites were always numerous at the time of death.

The principal symptoms, according to these authors, are oedema of the genital organs and hypertrophy of the inguinal lymphatics, although these symptoms may be absent. Less frequently oedema of the head and slight and transient paresis of the posterior extremities may occur. Important lesions of the nose and eyes are found only occasionally. The temperature rises on the third to the fifth day and usually remains above 40° C. until death. Considerable loss of weight is constantly observed.

In the Philippines dogs are very susceptible to surra by inoculation, and we have thus far observed two which contracted the disease naturally. Owing to their susceptibility and the ease with which an unlimited supply of the animals may be obtained for experimental work, they have been used in large numbers in the present investigation.

The incubation period is from four to seven days, the course is rapid, being from eight to twenty-four days in length, and the mortality is 100 per cent.

The temperature (figs. 122-124, 136-138) varies considerably, but is usually remittent and rarely runs as high as in some other species of animals. Death may occur with hyperpyrexia, but more usually it is preceded by a drop of the temperature to normal or subnormal.

The animals rarely live long enough for anæmia and emaciation to become extreme, but both are very noticeable from the beginning. In dogs the appetite, as a rule, is very poor, although there are exceptions in which it is ravenous throughout the entire course of the disease. The bowels remain normal.

The "bulldog head," produced by the subcutaneous oedema about the face, occurs to a varying degree, which depends somewhat upon the length of time the animal lives. Oedema of the scrotum and belly is also present, but sometimes where the course is very rapid it may scarcely be noticeable.

Urticarial eruptions on various parts of the body are hardly a prominent symptom; they do occur, however, and occasionally are very marked. As in other animals the

hair becomes rough and falls out; this is especially true of the eyelashes and the long hairs about the nose.

Catarrhal symptoms, accompanied by watery discharges from the nose and eyes, are noticed early, and later become severe. The discharges become muco-purulent and acrid, excoriating the sides of the nose. Clouding of the fluid in the anterior chamber is of frequent occurrence and may lead to total blindness. Partial deafness also occurs. In many cases the partial paralysis of the hind quarters seen in other animals is also observed. Parasites as a rule are constantly present in the blood from the time of their first appearance until death. Post-mortem examinations show lesions closely resembling the ones found in other animals.

TRYPANOSOMIASIS OF GOATS.

This species of animals is apparently not susceptible to natural infection, and on inoculation the disease runs so chronic a course that some authors consider them immune. The duration and the mortality do not appear to be well defined.

Rost says that goats inoculated with surra blood have fever, but soon recover, and subsequent doses do but very little harm. They are refractory to the disease, and parasites are not generally found in the blood.

Voges considers them susceptible to mal de caderas by inoculation and says the disease lasts for several months. The animals at first show no symptoms, and often do not do so for months; but emaciation finally begins and death is usually sudden. *Trypanosoma* are periodically absent from the blood.

Bruce considers goats susceptible to nagana by inoculation, but says that the disease runs a chronic course, often lasting for several months.

Laveran and Mesnil inoculated a goat with *Tr. brucei*, and it was still alive at the time of publication of their article, three months later. They say that the beginning of the disease in these animals is much the same as in horses, the incubation period being from three to eight days, followed by a rise of temperature to about 41° C. Parasites are only temporarily present, and are not again found, but the blood continues to be infectious by inoculation.

In our experience goats have always proved susceptible by inoculation. Parasites are usually scarce in the peripheral circulation, and indeed in some of our animals were not found at any time during the disease; but the blood was always infectious by inoculation, and the disease invariably proved fatal.

The incubation period varies in length, and is difficult to determine accurately without daily animal experiment. The temperature curve is illustrated in figs. 126-128, 140-142, and does not show anything characteristic, nor does it differ much from that of other species of animals. Neither emaciation nor anæmia are marked. Edema is never prominent, and may be entirely absent. Paresis of the hind parts was observed in only one of our animals.

Goats manifest their illness by preferably lying in the shade, and by the listlessness and sluggishness of their movements. They seem to suffer some pain, just as is the case with monkeys.

Post-mortem examination reveals nothing characteristic, the lesions closely resembling those observed in other animals.

TRYPANOSOMIASIS OF SHEEP.

Most authors writing of surra, nagana, dourine, and mal de caderas regard the nature of the disease in these animals as very similar to that in goats. The sheep of eastern Africa are considered by Bruce to be somewhat refractory. The disease in these animals, he says, runs a very chronic course, and some of them live for five months.

Laveran and Mesnil inoculated a sheep with *Tr. brucei*, and in an article published three months later stated that it was still living. They consider the beginning of the disease much the same as in horses. There is generally an incubation period of three days, followed by the appearance of parasites and an elevation of the temperature to 41° C. *Trypanosoma* then become so rare that they are not found in the blood by microscopic examination, although the blood is constantly infectious when injected into mice. The temperature remains near 40° C., with occasional intermissions, although it sometimes rises to 41° C.

Regarding one sheep, which lived exactly one hundred and ninety-seven days, they write as follows:

"On the sixth day after inoculation it showed a temperature of about 41° C., which shortly afterwards fell to between 39° and 40° C.; on the twenty-fourth day there was another rise to 41.5° C., after which the temperature remained for a long

BUREAU OF GOVERNMENT LABORATORIES.
BIOLOGICAL LABORATORY.

ANIMAL RECORD.

Goat No 143

January 2, 1903

Weight _____ Age _____ Sex Male Color _____ Inoculation Tr. EvansiHistory Healthy animal under observation for 2 months.

TREATMENT	34	35	36	37	38	39	40	41	42	Date	RESULTS.
<u>2 c.c. Surra blood</u>										Jan. 2	Tryp. neg.
										3	
										4	
										5	Tryp. neg.
										6	
										7	
										8	Tryp. pos.
										9	
										10	
										11	
										12	Tryp. pos.
										13	
										14	
										15	Tryp. neg. Very ill
										16	
										17	
										18	
										19	
										20	Dead.

FIG. 141.—Temperature record of surra in a goat.

BUREAU OF GOVERNMENT LABORATORIES,
BIOLOGICAL LABORATORY.

ANIMAL RECORD.

Goat No 131

December 31, 1902

Weight _____ Age _____ Sex _____ Color _____ Inoculation Surra _____
History _____ Healthy native goat under observation for three months.

TREATMENT	34	35	36	37	38	39	40	41	42	Date	RESULTS
1 drop tryp. blood from Horse No. 91.										Dec. 31	
										Jan. 1	
										2	
										3	Tryp. neg.
										4	
5 drops tryp. blood from Horse No. 147										5	Tryp. neg.
										6	
5 drops tryp. blood from Horse No. 147.										7	
										8	Tryp. neg.
										9	
										10	
										11	
										12	Tryp. neg.
15 drops tryp. blood from Horse No. 110.										13	Tryp. neg.
										14	
										15	Tryp. neg.
50 drops tryp. blood from Horse No. 148.										16	
										17	
										18	
										19	
										20	Tryp. neg.
										21	
										22	Tryp. neg.
										23	
100 drops tryp. blood from Mule No. 151.										24	
										25	
										26	
										27	
										28	
										29	Tryp. neg.
										30	
										31	
										Feb. 1	
										2	Very ill, sub- cutaneous edema.
										3	
										4	Tryp. neg.
										5	
										6	
										7	
										8	
										9	Edema, animal very ill.
										10	
										11	

FIG. 142.—Temperature record of a goat repeatedly inoculated with *Tr. evansii*; parasites not found by microscopic examination.

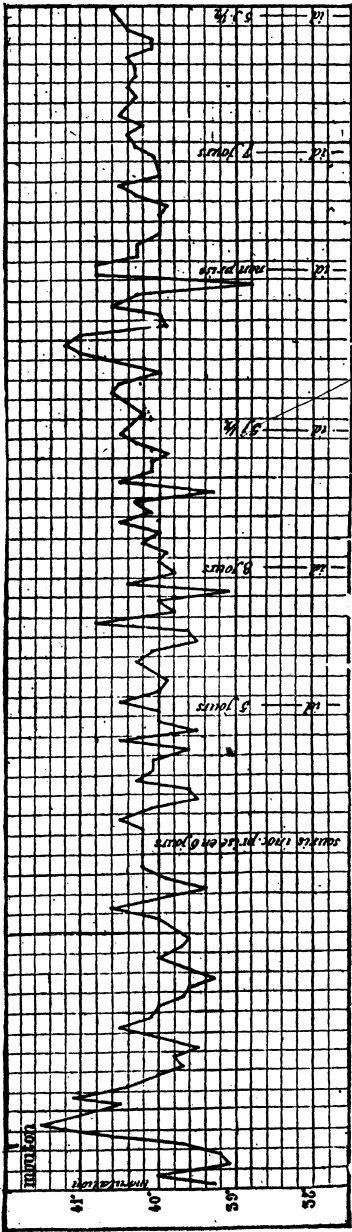


FIG. 143.—Surra in sheep. (After Laveran and Mesnil, 1902, fig. 6.)

BUREAU OF GOVERNMENT LABORATORIES.
BIOLOGICAL LABORATORY.

CASE I.

June 2, 1903.

Weight 900 Age 15 Sex Male Color Black Inoculation Rinderpest
History from Shanghai

[illegible]

BUREAU OF GOVERNMENT LABORATORIES.
BIOLOGICAL LABORATORY.

ANIMAL RECORD.

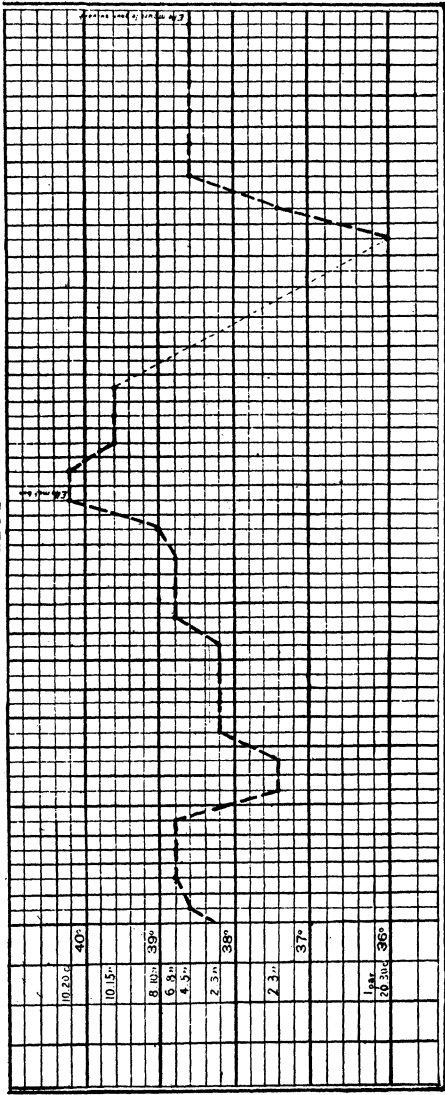
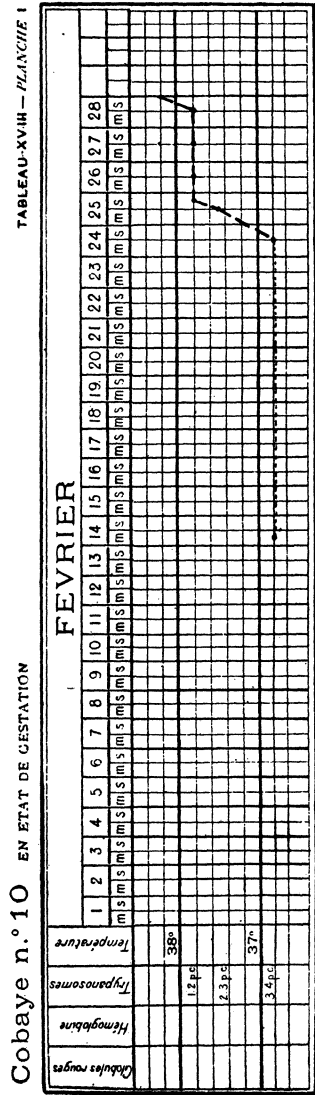
Sheep No. 220

June 25, 1903

Weight _____ Age _____ Sex _____ Color _____ Inoculation 3 c.c. surraHistory — Large, healthy native sheep blood

TREATMENT.	34	35	36	37	38	39	40	41	42	Date.	RESULTS.
-3 c.c. surra blood subcutaneously										June 25	
										26	
										27	
										28	
										29	
										30	
										July 1	
										2	
										3	
										4	Tryp. neg.
										5	
										6	
										7	
										8	
										9	
										10	
										11	
										12	
										13	
										14	Tryp. neg.
										15	
										16	
										17	Tryp. neg. (Tryp. pos. by animal experiment)
										18	
										19	
										20	
										21	
										22	
										23	
										24	

FIG. 144.—Temperature record of surra in a sheep.



BUREAU OF GOVERNMENT LABORATORIES.
BIOLOGICAL LABORATORY.

ANIMAL RECORD.

Guinea pig No 248

April 16, 1908

Weight _____ Age _____ Sex _____ Color _____ Inoculation surra.

History Small healthy animal, Temperature record after 1st. day of the disease.

Parasites were present in the peripheral circulation after 7th. day.

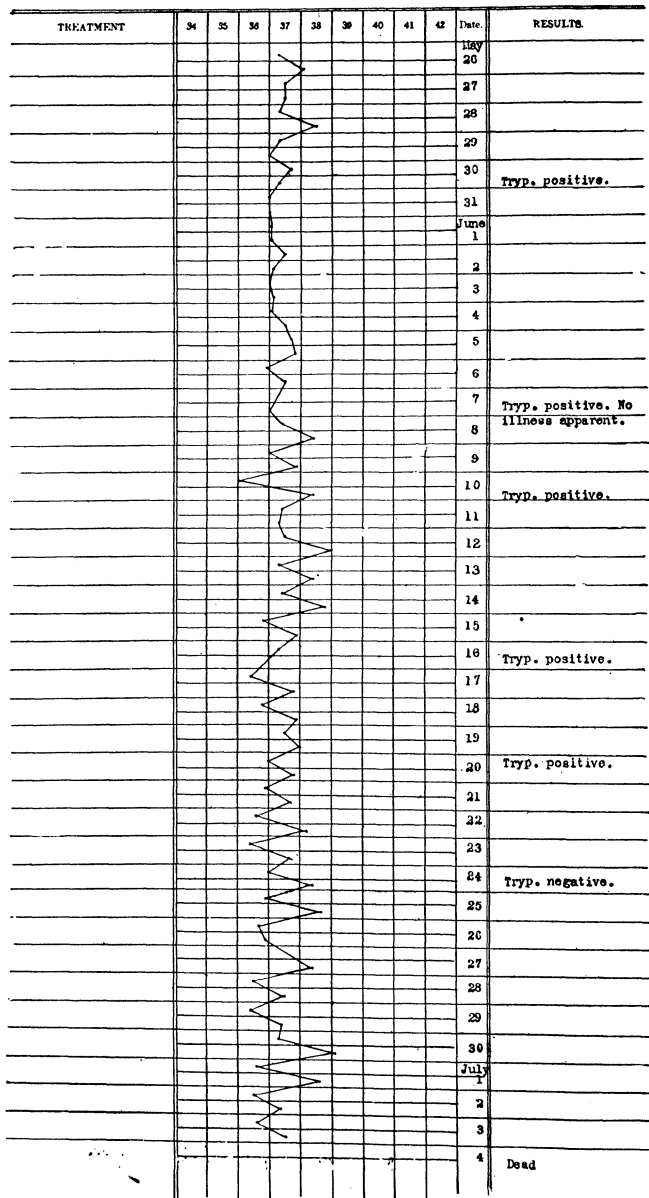
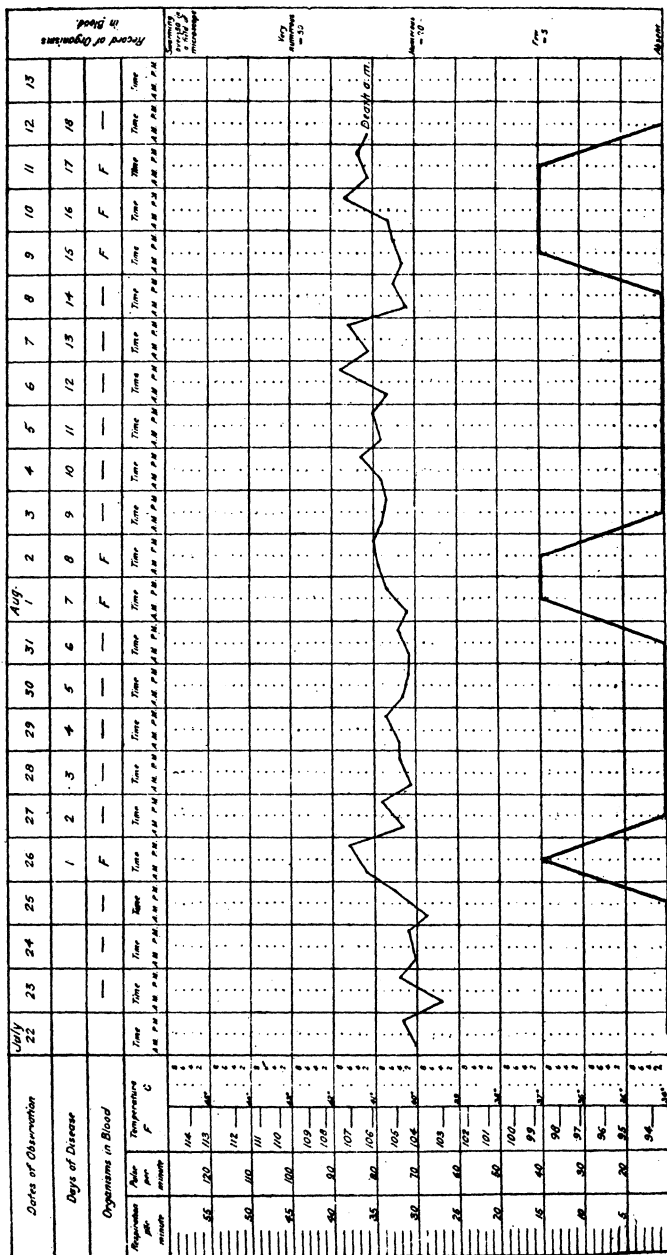


FIG. 146.—Temperature record of surra in a guinea pig.

RECORDS OF TEMPERATURE, PULSE AND RESPIRATION.

Rabbit inoculated with 0.75 cc. of blood from the heart of Horse No. LXII
 Disease, Rot Surra Date of inoculation, 22 July 1892 Result, Death Date of Result, Aug. 12, 92 Register No. II Age, 2 Sex, Buck Colour, White



Non-Febrile curve
 Temperature

Fig. 147

Fig. 147.—Temperature record of surra in a rabbit. (After Lingard.)

BUREAU OF GOVERNMENT LABORATORIES.
BIOLOGICAL LABORATORY.

ANIMAL RECORD.

Rabbit. No. 169

January 26, 1902

Weight.....Age.....Sex.....Color.....Inoculation of mule dead of surra.

History.....

Large healthy animal under observation for months.

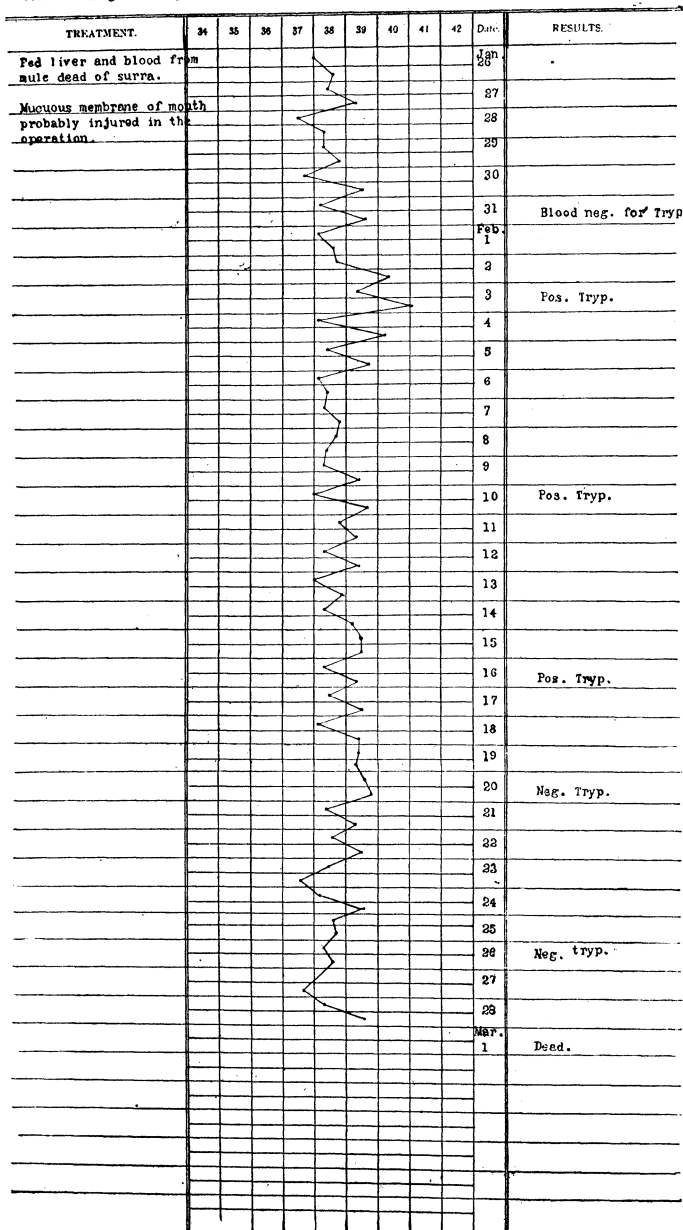


FIG. 148.—Temperature record of surra in a rabbit.

BUREAU OF GOVERNMENT LABORATORIES
BIOLOGICAL LABORATORY.

ANIMAL RECORD.

Rabbit No 168
January 26, 1903
Weight _____ Age _____ Sex _____ Color _____ Inoculation Trypanosoma
History _____
Healthy animal under observation for months.

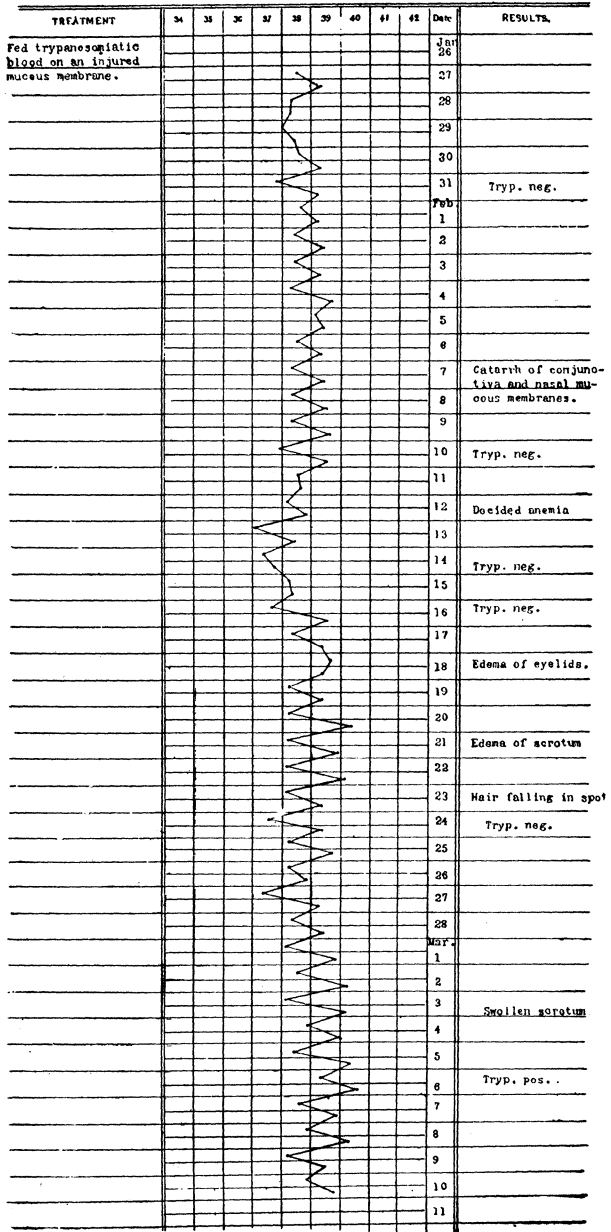


FIG. 149.—Temperature record of surra in a rabbit.

time in the neighborhood of 41° C., taking thirty days to return to 40° C.; multiple œdematous areas appeared in the face and eyes and then in the testicles. It was only during this period that *Trypanosoma* could be found by microscopic examination, and for eight days there were several in the field. The œdema increased and extended to the neck and shoulders (end of the third month). Its disappearance was rapid; the animal (during the fourth and fifth months and the first half of the sixth) appeared well, the temperature being between 39° and 40° C., but the blood was still virulent. During the last month the animal emaciated rapidly and died with profound lesions of cachexia and gelatinous exudates of the throat, the pericardium, and the lips."

As with some of the other animals, neither the study nor the description of the infection in sheep is as accurate as might be desired for purposes of comparison. In the Philippine Islands they do not appear to be naturally susceptible to the disease. We have kept a sheep in the same ground with surra animals for several months, but no infection has resulted.

The symptoms, the course, and the duration of the disease in these animals are so similar to those observed in the goat that a description of them is considered unnecessary.

TRYPANOSOMIASIS OF GUINEA PIGS.

There are on record a few instances in which guinea pigs have been found naturally infected with *Trypanosoma*, but literature affords little detailed study of any of the forms of the disease in these animals. It is admitted that they are susceptible by inoculation to *Tr. evansi*, *Tr. brucei*, and *Tr. elmassianii*, while some of them show a transient infection from *Tr. lewisii*.

Laveran and Mesnil noticed multiplication forms on the second and fifth days after inoculating one of these animals in the abdominal cavity with *Tr. lewisii*. Many of the parasites in the abdominal cavity were in various stages of digestion by the large mononuclear leucocytes. There were a few *Trypanosoma* in the blood on the fifth and seventh days.

Sivori and Lecler give sixty days as the average duration of *surra americana* in these animals, although it varies from twenty-five to one hundred and sixty days. In pregnant females parasites are more numerous than in other cases and almost constantly present.

Voges says that one-half to two-thirds of these animals when inoculated with male caderas die of the disease, the duration of the disease in those which finally succumb being from two to five months. He has some guinea pigs that have been alive for a year, have grown fat, and have had young. The generative power of the male suffers from the infection more than does that of the female.

We have succeeded, as did Laveran and Mesnil, in producing a slight infection with *Tr. lewisii*, but it is always transient and devoid of symptoms.

Guinea pigs do not naturally contract any form of trypanosomiasis in this country, but when inoculated with the *Trypanosoma* of the present epidemic always show a long chronic infection.

As nearly as can be determined, the incubation period varies from two to eleven days. The duration of the disease is from one to four months, and but few animals recover from it.

The appearance of parasites in the circulating blood is very intermittent but always in sufficient numbers for microscopic diagnosis, although the blood is constantly infectious by animal experiment. Sometimes parasites are not found by the usual microscopic technique for days and even weeks.

The temperature curve (see fig. 132, 146) is very irregular, more so than in any other class of animal with which we have worked. The symptoms in general resemble those of the rabbit. Œdema of the genitals is marked, but in the rest of the body is less prominent than in the case of other animals. Anæmia and emaciation develop slowly, but reach an extreme degree before death. The hair falls out in places and small ulcers may appear on the belly and the prepuce or vulva. Partial paralysis of the hind parts occurs but is not constant, being absent in some cases while well marked in others.

Post-mortem examination reveals a condition similar to that observed in many other animals. There is as a rule less fluid than is ordinarily found in the serous cavities of other animals, and the changes in the spleen are often slight. The gelatinous infiltrations in the subserous and subcutaneous tissues closely resemble those seen in the horse.

TRYPANOSOMIASIS OF RABBITS.

Rabbits are susceptible by inoculation to all the important forms of trypanosomiasis, but we have read of no reported cases of natural infection in these animals.

Rouget very irregularly found the parasites in the blood of rabbits suffering from dourine, but their presence in the peripheral circulation was intermittent and bore no relation to the temperature of the animals. As the principal symptoms he gives oedema of the ears, falling out of the hair, paralysis of the hind parts, mucous conjunctivitis, which later becomes purulent, and oedema of the genitals. The duration of the disease is from one to four months. The principal anatomic lesions are hyperæmia of the abdominal layers, inflammation of the spleen and liver and of the lymphatics near the point of inoculation.

Mal de caderas, according to Voges, lasts for one to three months in these animals. Parasites may not be found in the blood for the first four weeks. The rabbits remain active for weeks, but toward the end emaciation is apparent. The fever is very irregular. Catarrhal conjunctivitis supervenes, becoming purulent and causing the lids to adhere to each other. The hairs of the eyelids always drop out, and sight finally becomes greatly impaired. Inflammation of the nose occurs, causing the hairs to stick and fall out. The testicles swell, but the penis is unaffected. *Trypanosoma* are found in the inflamed testicles and vulva, and on necropsy, indeed in all parts of the body. The spleen is enlarged and serous exudates are always observed.

Sivori and Lecler, working with the *surra americana* of South America, say that parasites may be found in the blood eight hours following intraperitoneal inoculation, and that the duration of the disease is from sixteen to one hundred and sixteen days. The disease is characterized by emaciation, tumefaction of the eyelids, purulent blepharo-conjunctivitis, and marked oedema of the nose, penis, and vulva. The temperature is irregular and without relation to the number of parasites in the circulating blood.

Kanthuck, Durham, and Blandford regard the rabbit as relatively immune to nagana. They say that the incubation period is from five to seven days, and the duration from twenty to one hundred and eighty-three days, the average being about fifty.

Laveran and Mesnil consider it to be a susceptible animal. The incubation period is from two to four days, and the duration of the disease from fifteen to thirty, although death sometimes occurs in five to six days. Parasites appear in the peripheral circulation intermittently. When the disease lasts twenty days or more, conjunctivitis sets in and the hair about the eyelids falls out; oedema of the vulva or prepuce and forelegs occurs, but the lesions are always slight. During the whole course of the disease the rabbit has a continuous temperature, with rare intermissions; it is generally above 40° C.

In this country rabbits have not been found naturally infected. They are susceptible by inoculation and afford most interesting subjects for the study of the disease. Fig. 133, 147 illustrates the course of *surra* in these animals, as given by Lingard.

The incubation period is difficult to determine accurately for the reason that, contrary to the results obtained from many animals, it is not, as a rule, followed by a sharp rise of temperature and the appearance of parasites in the blood, a fact which probably accounts for the great variations in the length of time assigned to it. In fact, there does not appear to be a distinct incubation period in all cases, for in some cases animal experiment may prove the blood infectious as early as eight hours after inoculation, while in others it does not become so until the fourth or fifth day. The course of the disease is somewhat chronic, lasting from fifteen days to three months or more, with a mortality of 100 per cent.

It is seldom that parasites are numerous in the peripheral circulation, and determinations by simple microscopic examinations show that intermissions are frequent, lasting from one or two days to several weeks, during which parasites are not found. As in other animals, however, the blood is continuously infectious by animal inoculation. The temperature (see figs. 134-135, 148-149) throughout the disease is less markedly remittent than is usual in most animals, while exacerbations and remissions are rare.

Anæmia and emaciation come on rather slowly, but develop to an extreme degree before death. Watery discharges from the nose and eyes appear early, gradually becoming muco-purulent and tenacious, solidifying on the margins of the eyelids and nose and incrusting and entangling the long hairs, which fall out and leave excoriated surfaces. (See fig. 136, 150.) Oedema occurs around the base of the ears, the nose, and the abdomen, involving especially the scrotum, which becomes enormously distended and may break open and suppurate. (See fig. 137, 151.) There is a discharge from the prepuce similar to that from the eyes and nose. In the female the



FIG. 150.—SHOWING MUCO-PURULENT DISCHARGE FROM EYES, FALLING OF LONG HAIRS, BLEPHARITIS AND CONJUNCTIVITIS IN RABBIT.



FIG. 151.—SHOWING ENORMOUS SWELLING OF GENITALS IN RABBIT WITH SURRA.

external genitals are scarcely less affected than in the male. Urticarial eruptions and falling out of the hair are common symptoms. Lameness of the hind parts occurs in most cases, and may reach such a degree that the posterior extremities become useless. The subcutaneous lymphatics are often palpable, and in some instances swelling of the joints occurs.

Necropsy reveals lesions similar to those observed in other animals. The lymphatics, particularly of the inguinal and postperitoneal regions, are somewhat enlarged and red in color. The serous sacs contain fluid and often show fibrinous flakes over the surfaces and adjacent organs. The spleen is usually enlarged and friable, but a typical acute splenic tumor is often seen, while "sago spleen" occasionally occurs.

TRYPANOSOMIASIS OF CATS.

Cats are reported susceptible by inoculation to surra, nagana, dourine, and mal de caderas, but the course of the disease does not seem to have been carefully studied in them. Fig. 152 illustrates the course of the temperature in surra, as given by Lingard. Fig. 153 that of "surra americain," as given by Sivori and Lecler.

In the Philippine Islands they are susceptible to the infection by any of the usual forms of inoculation. The incubation period is from two to five days, the course rapid, varying from three to fifteen days, and the mortality 100 per cent.

Parasites are constantly present in the blood, but vary considerably in numbers at different times. The temperature curve is illustrated in figs. 154-155.

Skin lesions in these animals are very prominent and are similar to those described for dourine. Urticarial and macular eruptions are common, and not a few animals show phlegmamous ulcers, particularly on the abdomen and flanks. Edema is slight.

The hair, particularly about the nose and eyes, becomes rough and falls out. Profuse discharges from the nose and eyes, resembling those in the case of the rabbit, are a usual symptom. Cloudiness of the fluid in the anterior chamber and opacity of the cornea may occur in one or both eyes. Anæmia is profound and emaciation moderate. The appetite is usually poor, but the bowels remain normal. Tendency to paralysis in the hind quarters was noticed in only one animal.

Necropsy reveals the usual lesions, in addition to the changes already mentioned as present during life. The acuteness of the disease in these animals probably accounts for the fact that the lesions are less pronounced. The spleen is enlarged, but assumes more nearly the type of acute splenic tumor, while subserous hemorrhages are numerous.

TRYPANOSOMIASIS OF RATS AND MICE.

Tr. lewisii, the common *Trypanosoma* of rats, has already been described. Most writers agree that it is harmless for rats and noninfectious, by inoculation or otherwise, for other animals.

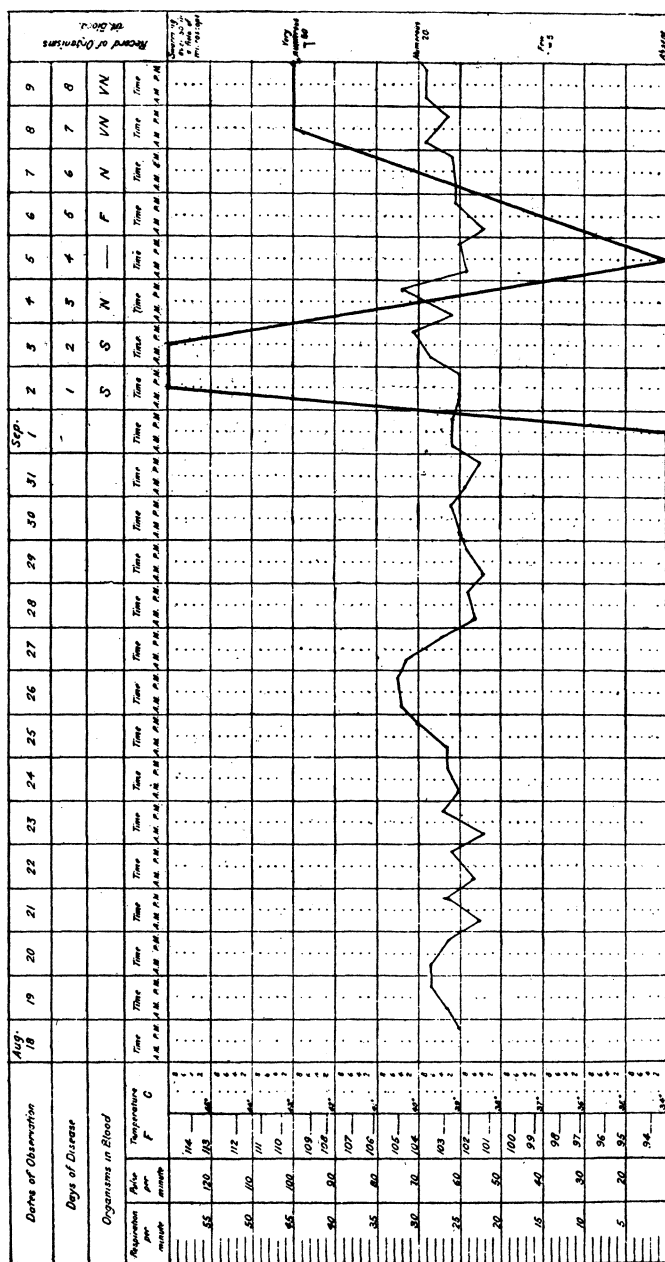
Large numbers of rats have been found naturally infected in various parts of the world; a partial list of the regions is as follows: Lewis, in Calcutta, found 29 per cent infected; in Bombay, Carter found 12 per cent infected and Lingard 30 per cent; Koch, in Africa, 41.7 per cent; Crookshank, in London, 25 per cent; Rabinowitsch and Kempner, in Berlin, 41.8 per cent; Laveran and Mesnil, in Paris, 4.6 per cent; Baillet, in Alfort, a large percentage; Chemette, at Lille, a large percentage; Sivori and Lecler, at Buenos Ayres, 3 per cent, and Chalachnikow and Danilewsky, in Russia, found the infection present. In Togo eight rats examined were negative (Luman). Voges, in South America, did not find these animals naturally infected. In a personal letter Kitasato, in Japan, states that many of the rats there harbor the parasite.

In Manila rats *Tr. lewisii* has been found in from 20 to 65 per cent of the individuals examined, varying according to the season and the locality from which they were received.

Van Dyke Carter inoculated dogs, cats, horses, and monkeys with rat *Trypanosoma* and always obtained negative results. Koch failed permanently to transfer the infection to other animals. He gave a rat *Tr. lewisii* and *Tr. evansii* and afterwards found both in its blood. He then inoculated a dog with some of this rat's blood, and the animal contracted the disease, but its blood was found to contain only *Tr. evansii*. The efforts of Rabinowitsch and Kempner to inoculate other animals with *Tr. lewisii* proved unsuccessful. In their experiments they used white and gray mice, field mice, guinea pigs, rabbits, dogs, goats, horses, and hamsters.

Lingard, on the other hand, inoculated twelve horses with infected rat blood, and four of them, after an average of seven days, died of a virulent form of surra. He argues that some *Tr. lewisii* are infectious for other animals, as demonstrated by his experiments. This statement has caused considerable confusion, and his work has

Cat	Age 3 Months	Sex Female	Colour
	Date of Birth	21 10 97	Breeder No T
	Date of Immigration	28 August 1899	
	Date of Death		
	From		



^x Incubated subcutaneously with 0.5 cc of blood containing very numerous *Stomatopoda* taken from the Jugular Vein of Donkey.

[illegible]

FIG. 152—Continued.

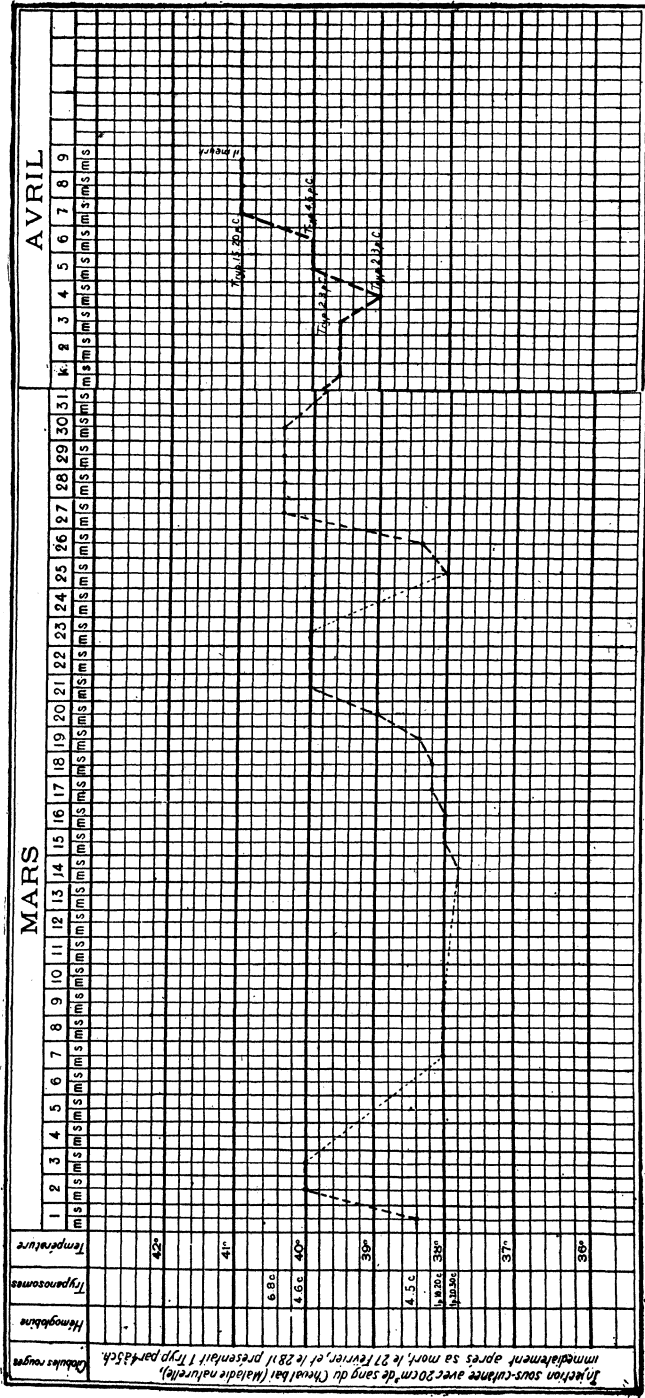


FIG. 153.—“Surra américaine” of cat. (After Sivori and Lecler, 1902, Pl. XX, pt. 1.)

been questioned. Judging from our observations in Manila, it would appear, however, that Lingard's mistake consisted in considering these pathogenic parasites *Tr. lewisii*.

Kanthuck, Durham, and Blandford showed rats to be refractory to a second inoculation with *Tr. lewisii*. Rabinowitsch and Kempner noticed that some rats are absolutely refractory to these parasites, but that most of them are susceptible. After inoculations into the abdominal cavity *Trypanosoma* were found to be present in the blood after from three to seven days, and occasionally at the end of twenty-four hours. In rats inoculated in the abdominal cavity they found multiplication forms to be numerous in the exudate during twenty-four to thirty-six hours, at the end of which they disappeared permanently from the abdominal cavity to reappear in the blood. Rats could not be given a second infection, no matter how large the dose of infected blood used; and they employed the important fact that some of the animals are refractory as a basis for the preparation of a specific serum.

Laveran and Mesnil in general confirmed Rabinowitsch and Kempner's work and in addition showed that the young born of immune mothers are very slightly if at all immune. They also demonstrated that the agglutinating properties of the blood are not transferred to young. In immune rats *Trypanosoma* are destroyed in the abdominal cavity, and the agglutinative power of the blood lasts no longer than the

BUREAU OF GOVERNMENT LABORATORIES.
BIOLOGICAL LABORATORY.

ANIMAL RECORD.

Cat No. 265
May 22, _____, 1903

Weight _____ Age _____ Sex _____ Color _____ Inoculation Tr. Evansi

History Small white cat.

TREATMENT.	34	35	36	37	38	39	40	41	42	Date.	RESULTS.
1 c.c. surra blood subcutaneously.										May 22	
										23	
										24	
										25	Tryp. pos.
										26	Tryp. pos.
										27	
										28	
										29	Dead.

FIG. 154.—Temperature record of surra in a cat.

preventive. In their opinion the treatment of rats with serum is unsuccessful. They state that as a rule the parasites appear in the blood at the end of twenty-four hours, and that in not a few cases, especially in young rats, they are found in considerable numbers before this time. However, many cases came under their observation in which the parasites did not appear in the blood until two to seven days after inoculation, and indeed in a few instances no infection resulted at all.

Adult parasites are the first to be seen in the blood, then there is a period, rarely extending beyond the eighth day, when multiplication forms may be observed, after which adult parasites are visible throughout the course of the disease. They believe multiplication to take place in the abdominal cavity during the period from the first to the fourth day, and in the blood between the fourth and the eighth days, after which time multiplication forms are no longer present.

Infection of these animals with *Tr. lewisii* lasts from twenty days to four months or more. In old ones the *Trypanosoma* often disappear in two to ten days, and in these no active immunity is established. Subcutaneous inoculations, according to these authors, give infections which are less severe than those produced by other methods.

BUREAU OF GOVERNMENT LABORATORIES.
BIOLOGICAL LABORATORY.

ANIMAL RECORD.

Cat No 266

May 26, 1903

Weight _____ Age _____ Sex _____ Color _____ Inoculation Surra.

History _____ Medium-sized healthy cat.

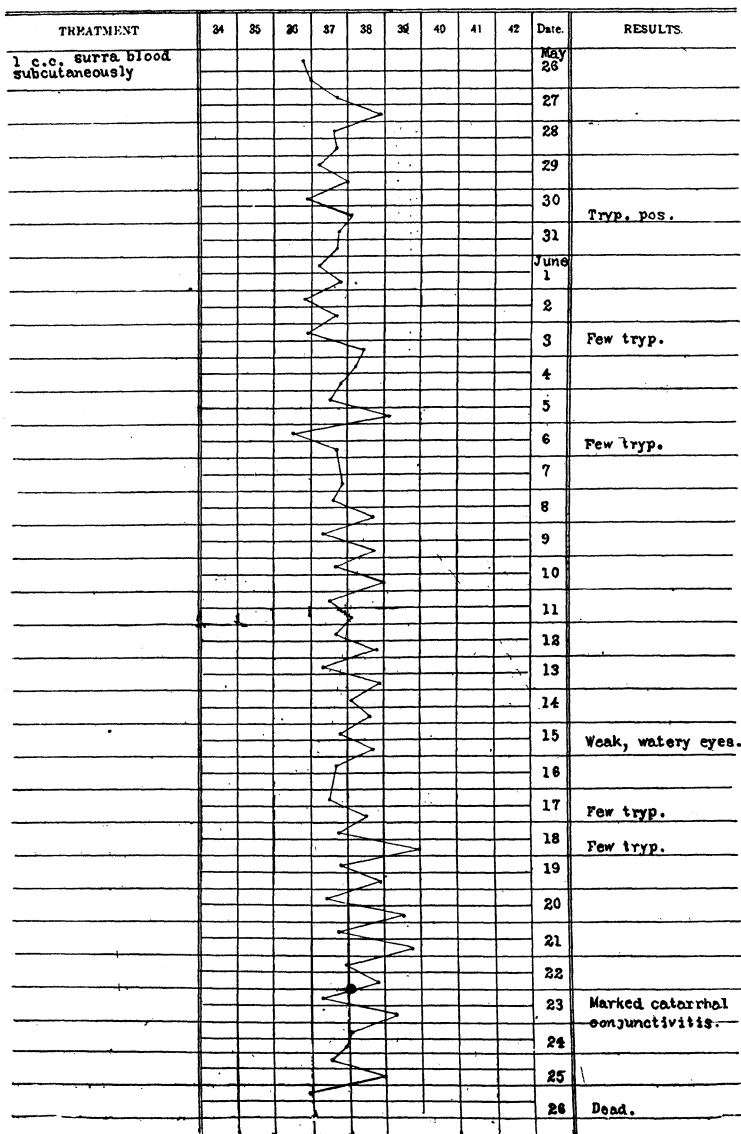


FIG. 155.—Temperature record of surra in a cat.

Blood infected with *Tr. lewisii* and kept on ice does not give an increased incubation period or produce any alteration of the infection, as long as motile parasites are found to be present. If, however, the blood is allowed to remain for a considerable length of time (forty-seven days), the incubation period is increased from six to nine days, and the infection is less severe. After fifty-one days or more on ice the blood no longer contains living parasites, but is still infectious for rats, with an incubation period of twenty-seven days. All writers agree that rats infected with *Tr. lewisii* show no symptoms of illness. The constant anatomic lesion is hypertrophy of the spleen.

Our work as a whole has been in conformity with that of others. In the thousands of rats found to be naturally infected with *Tr. lewisii* and in those inoculated, we have never observed either apparent illness or death which could positively be attributed to infection with this parasite, although it was present in enormous numbers in the circulating blood. Our observations have been exceptionally easy on account of the great number of rats furnished the laboratory for examination to determine the possibility of their infection with plague, since this disease has become endemic in Manila.

Very little is found in literature relating to the clinical manifestations and morbid anatomy of surra in rats. We have not seen a specific reference to the natural infection of these animals by *Tr. evansii*, though from our experience, which is to be described later, it is believed that Lingard must in some of his experiments have been working with such an infection.

Lingard states that the latent period in *Mus decumanus*, as developed by the subcutaneous inoculation of 0.1 to 0.2 c. c. of virulent blood, varies from one to two days; and in *Nesokia providens*, by subcutaneous inoculation of 0.2 c. c., from two to five days.

Kanthuck, Durham, and Blandford state that rats, when inoculated with nagana-infected blood, often exhibit convulsive seizures just before death, but otherwise show no symptoms of the disease, except dullness in the later stages. Transmission from one animal to another by coition, by suckling, or by any other method than by direct inoculation was not observed. Infected mice lived from eight to twenty-five days and rats from six to twenty-six days.

As the morbid anatomy of nagana in rats and mice, they describe lymphatic hyperplasia, most noticeable near the point of inoculation, congestion, œdema, and occasionally hemorrhages of the glands, great enlargement of the spleen, which is generally firm, friable, and dark in color, enlargement and fattiness of the liver, and occasionally a small amount of fluid in the pleural cavity.

Laveran and Mesnil state that in rats and mice of all varieties, including white ones, nagana has a perfectly regular course. No symptoms are manifest, the animal appearing well until near death. Mice appear sleepy and die without suffering from dyspnoea. One mouse had convulsions two hours before death. Some rats die with the same symptoms as mice, but most of them show great agitation just before death, crying out and dying in severe convulsions. There are no sensible variations of temperature in these animals. Parasites appear in the blood twenty-four hours or more after inoculation in the abdominal cavity, and on the second or third day after subcutaneous inoculation. They progressively increase in number until death. In white rats and mice death occurs in two and one-half to three days after intraperitoneal inoculations, and after three and one-half to five days following subcutaneous inoculations. Wharf rats (*Mus decumanus*) die in about the same length of time as white rats (*Mus rattus*).

According to Rouget, mice inoculated with *Trypanosoma* of dourine show no symptoms until near death, when the hair becomes rough and the cornea cloudy. The post-mortem changes observed are hyperemia of the abdominal layers, inflammation of the liver and spleen and of the lymphatics near the point of inoculation. Parasites are found in all of the organs and fluids except the intestines and the urine.

Voges says that death may occur without any preceeding signs of illness. In rats and mice inoculated with the *Trypanosoma* of mal de cadras there may be a few hours of comatose condition. The duration of the disease in these animals is given at about four weeks.

As has been stated above, the natural infection of rats with the *Trypanosoma*, which cause the disease in domestic animals has not before been reported, except perhaps, by Lingard, who, if such was the case in his work, misinterpreted his results.

In a preliminary report on Trypanosomiasis in the Philippine Islands, published as Bulletin No. 3, of the bureau of government laboratories, 1903, Musgrave and Williamson reported that a certain number of rats in Manila were found to be infected with the *Trypanosoma* which in this country causes surra in horses. This discovery

was brought about by accident, while the authors were attempting to immunize a monkey with a parasite supposed to be *Tr. lewisii*. As a result the animal contracted surra and died. At first, following Lingard, we thought this to be a pathogenic *Tr. lewisii*, or supposed accidental infection with *Tr. evansii* to have occurred; but more careful study and the repetition of the experiment with the greatest precautions has demonstrated that a small percentage of these rats harbor the parasite causing the disease in the horse. This *Trypanosoma* has the same morphologic characteristics and upon inoculation is infectious for the same animals, producing the same disease with the same incubation period, course, termination, and lesions.

Wild rats are very unsatisfactory material to work with, because so many die after being in captivity a short time. The duration of life is so uncertain that but little confidence can be placed in results, even when control animals are used. The ones which live for a week or more after caging are likely to survive for some time, and in order to obtain the best results these have been employed as far as possible in our experiments.

As has been shown in other countries during the study of the disease in these animals, the infection is not evidenced by any symptoms of moment until just before death, when convulsions often occur. Too much importance should not be attached to this symptom, for time and again we have seen our control animals die in the same manner. Wild rats suffer such great excitement during the taking of temperature that no conclusions can be based upon the results. We must therefore believe that rats and mice infected with surra show no constant symptoms of practical significance. Some of the rare manifestations are cloudiness of the fluid in the anterior chamber, falling out of the long hairs about the head, and in a few cases oedema and a tendency to paralysis of the hind quarters. The incubation period, as determined by the appearance of parasites in the peripheral circulation, varies from a few hours to five days or more, and the duration is from two to twelve days.

The post-mortem examination shows an enlarged spleen, which may be hard and friable, or more nearly approach acute splenic tumor, with the organ usually dark in color, and there is generally enlargement of the lymphatics, especially of the inguinal region, which may be hemorrhagic. The changes in the other organs are not significant, except in a small number of cases which show gelatinous infiltrations of the subcutaneous and subserous tissues.

These lesions, particularly the enlarged spleen, are found in rats dying from infection with *Tr. lewisii*, which is considered harmless. After discovering that a number of rats harbor *Tr. evansii* we suspected the ones which died supposedly from *Tr. lewisii* and showed enlarged spleen, etc., post-mortem to be in reality infected with *Tr. evansii*; but animal experiment absolutely disproved this theory.

The study of trypanosomiasis in rats has not been completed. It is certain that rats in Manila may be infected both with a *Trypanosoma* harmless by inoculation to other animals and with one pathogenic for them. These parasites correspond microscopically to the descriptions, respectively, of *Tr. lewisii* and of *Tr. evansii*. We are not fully convinced that *Tr. lewisii* is always harmless for rats, or that some of the rats in Manila do not even harbor a third species of parasite.

TRYPANOSOMIASIS OF FROGS, FISH, AND FOWLS.

Trypanosoma have been found in frogs obtained from points scattered over a large area of the world, but they are usually considered harmless in these animals. The infection, so far as we have been able to determine, is not artificially transferable from frog to frog or from frogs to other animals. As already mentioned, we have not been able to find *Trypanosoma* in the blood of frogs in this country, and these batrachians have not been proved to be susceptible by inoculation with any of the *Trypanosoma* we have studied.

A number of observers have found fish harboring *Trypanosoma*, but all agree that no symptoms are produced. The species reported as infected are trout, pike, redeyes, soles, and salt-water fish of the Mediterranean (species not given). The different species of these parasites have already been discussed.

Laveran and Mesnil, whose work is the most important in this line, found the infection of the redeye with *Trypanoplasma* to be very common, but proved the young rarely to be infected. In the sole, however, trypanosomiasis is uncommon, being found in only four cases out of a large number of fish examined. They did not observe any symptoms of disease in fish caused by *Trypanosoma* and were unable to transfer the infection by inoculation. Doflein, during a fatal epidemic in fish, found *Trypanosoma* in a number of the diseased ones, but he was not sure of any pathogenic action of the parasites.

We have examined a number of fresh and salt water species of fish in Manila, but have been unable to find *Trypanosoma* in any of them, nor have we been able to infect them with *Tr. lewisii* or *Tr. evansii*.

It has already been shown in the discussion of *Trypanosoma* that some birds are occasionally found to harbor a specific *Trypanosoma*, which, however, does not appear harmful to them. With reference to the inoculation of *Tr. evansii*, *Tr. brucei*, *Tr. rouletii*, and *Tr. elmassianii* into birds, the evidence is somewhat contradictory for the different species. Most writers agree that birds are not susceptible to infection, but Voges, writing of mal de caderas, considers turkeys, ducks, and chickens susceptible by inoculation. He says that chickens die in from two to three weeks, in great agony, from either subcutaneous or intraperitoneal injections. The only symptom noticed is emaciation, and parasites are very few in number in the circulation.

We have so far experimented with several varieties of birds, including mayas, pigeons, doves, and chickens, but have been unable to infect them. No symptoms are produced, parasites are not found, and the blood proves noninfectious when inoculated into susceptible animals.

TRYPANOSOMIASIS OF MAN.

In 1898 Nepveu published an account of the occurrence of *Trypanosoma* in human beings. An extract from his article, translated, reads as follows:

"So far *Trypanosoma* have been found only in the blood of animals. In India they have been found in the blood of the rat (Lewis), the horse (surra epidemics), the dog, and the domesticated elephant. In Africa they have been discovered in the disease caused by the tsetse fly, and in Europe in the blood of the rat, the rabbit, various birds, and the frog. No one seems to have as yet observed them in man, although Laveran states that Barron found certain flagellated protozoa of an undetermined genus in the blood of an anæmic woman. In 1890, while making researches on malarial parasites in Algiers, I found flagellates in the blood of a patient, besides *Laverania*, and I was able to count three to each preparation of 18 square millimeters. At about that time (see Nepveu, *Etudes sur les Parasites du Sang chez les Paludiques*, 21, 1891, in *Bulletin et Memoires de la Société de Biologie*) I published some of the drawings I had so far collected. I hoped then that I might be able to complete my first observations by a more detailed study, but since then I have rarely been able to find the parasites. I have, therefore, decided to publish the following facts, in the hope of drawing the attention of such naturalists and physicians as will have the opportunity of completing these researches. * * *

"In over 200 patients, mostly malarial, of whom I have examined the blood, I have found these various forms of *Trypanosoma* in only six, three of whom were suffering from quotidian fever (Khill, Langevelle, and Bichielli), one from double tertian (Hendrick), and two from pernicious comatose fever (Cabane and Ginestet), while the seventh observation was made on Doctor X, who was apparently in good health. In none of these patients have I been able to observe any symptoms characteristic of this special parasitic invasion. They were almost all suffering from the effects of *Laverania*, which prevailed everywhere in its various forms. This seems, therefore, purely a coincidence, which has appeared to me worthy of notice."

His article attracted very little attention, some writers mentioning his work with the remark that his descriptions were inaccurate, and many overlooking it entirely. He did not attach clinical importance to the appearance of these parasites in the blood, but his remarks regarding them seem to us perfectly clear as to the occurrence of *Trypanosoma* in the blood, sufficiently so as to entitle him to credit for priority in the discovery of *Trypanosoma* in the human blood. His description does not appear sufficiently ample to designate the species of his parasite; but when one considers the confusion which exists even at the present time regarding the classification of these organisms, Nepveu can not be denied the credit because in 1898 he failed to classify his *Trypanosoma*. The parasites more recently discovered in human blood, as in his case, have not been clearly classified. Nepveu observed seven cases.

The eighth case of trypanosomiasis in man is published in the *British Medical Journal* for January 1, 1902, in an editorial and telegram from Dutton, in which he announces the discovery of *Trypanosoma* in a European, who displayed peculiar symptoms. The same journal for January 11, 1902, contains a letter from Ross, in which he gives Dutton credit for the following clinical data:

"The patient has been suffering from a form of relapsing fever with peculiar cedema of the eyelids and puffiness of the face, also cedema of the legs, general weakness, abnormal frequency of pulse and respiration, and enlarged spleen. There was no organic lesion of the heart and kidneys, and no malarial parasites were found after repeated examinations. The relapsing fever recalls that of horses suffering from the

same parasite. It is not yet certain whether the parasite approximates *Tr. brucei* or *Tr. lewisi*."

Dutton considers the most valuable features presented by his case as (1) its chronic course, (2) the general wasting and weakness, (3) the irregular rise of temperature, which is never very high and of a relapsing type, (4) the local oedemas, (5) the congested areas of the skin, (6) the enlargement of the spleen, and (7) the constant increased frequency of pulse and respiration (hurried breathing).

He examined the blood of 150 healthy children between the ages of 1 and 15 years, natives of Gambia, and says that he found *Trypanosoma* apparently identical with those observed in the European—the ninth case. This child is reported as showing no clinical evidence of the disease.

Forde (Journal Tropical Medicine, September 1, 1902) publishes the case already described by Dutton. He deals particularly with its history and symptoms previous to Dutton's personal observations.

The patient was a European, 42 years old, and at the time he came under Doctor Forde's care, May 10, 1901, at the Colonial Hospital, Bathurst, was a man of robust constitution, living a regular and steady life.

He was at first thought to be suffering from malarial fever, but quinine produced very little change in the course of the temperature. His blood was examined and malarial parasites were not found, but in nearly every specimen Forde found "small worm-like bodies," which he at first considered a species of *Filaria*. After repeated observations, however, the diagnosis became doubtful, and he associated these bodies with the symptoms of the disease.

The patient was invalided to Europe and returned to Bathurst in December, 1901. At this time Doctor Dutton, being informed of the case and examining the patient's blood, again found parasites, and immediately recognized them as *Trypanosoma*.

Forde gives as the chief characteristics of this case: (1) The irregular, intermittent temperature; (2) the oedematous condition of the face and lower extremities; (3) the rapid and variable pulse and respiration, unaccompanied by any evident cause; (4) the loss of weight, with marked debility, wasting, and lassitude; (5) the persistence of these symptoms and their resistance to treatment.

In the Journal of Tropical Medicine for November 1, 1902, is published "A case of trypanosomiasis in a European," under the care of Doctor Manson—the tenth case. Manson had been struck by the peculiar clinical features of Forde's case, its chronic, irregular fever, the enlargement of the spleen, the oedema, especially of the face, and the very well marked erythema multiforma scattered over the trunk and limbs.

The patient under Manson's observation was the wife of a missionary, who had resided on the upper Kongo for about a year, and had been sent to Manson by Habershon. She had been suffering while on the Kongo from an irregular fever, which was still present when she came under observation, though she had been living in England for the past eight months, and had been drugged with quinine and arsenic.

On examining her Manson recognized the same grouping of symptoms he had seen in Forde's case. The patient was admitted to the hospital and her blood was examined daily for two weeks, but no *Trypanosoma* were found. While arrangements were being made to test the tentative diagnosis by injecting blood into animals, Doctor Daniels, while making a blood count, found a *Trypanosoma*, and on subsequent examinations more parasites were observed. In the British Medical Journal, May 30, 1903, this case is accurately described by Manson and Daniels.

Manson publishes the eleventh case of trypanosomiasis in human beings. The patient was a European lady who had resided on the Kongo. In this case an erythematous rash was a prominent symptom, preceding or accompanying the attacks of fever, which occurred every ten days and lasted each time for about three. The cause of the disease is attributed to the bite of some insect on the foot. Manson is inclined to attribute significance to a tick (*Argas moubata*) as a transmitter of the infection. Baker has recently reported three more cases in human beings in Uganda.

Broeden, according to a letter received by Doctor Manson, has discovered two more cases in human beings—the twelfth and thirteenth. Both of these were Europeans.

Of the sixteen cases of trypanosomiasis in man, two have been in apparently healthy persons, six associated with malarial fever, and eight have shown clinical symptoms apparently entirely due to the infection with *Trypanosoma*. In these five cases the clinical picture, which has already been reviewed, was peculiar and quite similar.

Castellani has reported the discovery of a *Trypanosoma* in the cerebro-spinal fluid of 20 out of 34 cases of sleeping sickness. He has described the parasite and proposed the name *Tr. ugandense*. Bruce has continued Castellani's work, and has

reported to the Royal Society the discovery of *Trypanosoma* in the fluid obtained by lumbar punctures in all of the 38 cases examined, and in 12 out of 13 of these cases he found the *Trypanosoma* also in the blood. The importance of this discovery can hardly be estimated at the present time, but it is certainly additional evidence of the increasing importance of this subject. Lishman has also recently reported the possible appearance of *Trypanosoma* in the blood of patients suffering with "dumdum" fever in India.

Since the beginning of the present work in Manila constant vigilance has been observed in order to discover the infection in man, but so far with negative results. Neither the clinical symptoms nor the parasites have been found. The blood of hundreds of cases of persons ill and in health has been examined, particularly that of persons who have come in close and frequent contact with animals suffering from the disease. Both writers of this article have repeatedly performed post-mortem examinations on animals which had been but a few minutes dead of the disease, and have been bitten by flies covering the infected organs, but without the slightest inconvenience. A number of assistants during the course of the work have often exposed open skin wounds to infection, both by blood directly and by biting flies, but all with negative results.

The reported cases show conclusively that human beings may become infected, and we shall continue our observations in this country, where the constant presence of the disease in animals, the sanitary conditions, and the anæmic state of most of the inhabitants would lead us to expect a case eventually to occur in a human being.

TRYPANOSOMA OF MISCELLANEOUS ANIMALS.

Here we shall briefly mention the notes found in literature relating to such animals as have contracted the disease, but in the case of which the clinical manifestations have been given but little detailed discussion and on which, owing to the lack of animals, no observations can be made by us.

Bruce proved by animal experiment 9 out of 35 wild animals examined in South Africa to be infected with *Tr. brucei*. The positive ones included 1 buffalo, 3 *nied-beuste*, 3 koodoo (*Strepsiceros kudu*), 1 buch-buck, and 1 hyena. Many of these animals showed no clinical evidence of disease.

Laveran and Mesnil, in mentioning the animals susceptible to nagana, give several species of antelopes, the dromedary, the hare, the mule, the hyena, the lapian, the hedgehog, the macque. Bruce mentions the babale and Brumt the chamois. Lingard and others say that buffaloes and elephants are susceptible. Sivi and Lecler refer to the carpincho and Voges to the nutria (*Myopotamus coypus*) among animals subject to the infection.

Voges considers the nutria extremely susceptible. Death occurs suddenly about ten days after inoculation, without symptoms.

Laveran and Mesnil say that wolves have an incubation period of two to three days and that death takes place in from five to twelve after inoculation. Parasites vary in number, but are usually to be found throughout the disease by microscopic examination of the blood. Cachexia and irregular fever are the prominent symptoms.

In strong, healthy animals the course of the disease is much longer, being twelve to fourteen days or more, and the period of incubation is from four to five days. The blood is always infectious, but parasites are not usually found in it by microscopic examination. Local symptoms appear in twenty to thirty days. Emaciation is not noticed until just before death.

The prominent symptoms, when once established, are conjunctivitis, coryza, œdema, particularly of the head, the legs, and the genitals; congestion of the testicles, or even a true orchitis; falling out of the hair about the eyes, nose, and base of the ears; opacity of the cornea; sometimes purulent conjunctivitis and blindness in the late stages; ulcers about the eyes, nose, and other parts of the body similar to those seen in dourine. In animals dying from twenty to thirty days after inoculation the marked clinical symptoms are not observed. English writers give the incubation period at eight days and the duration of the disease at twelve to fifty-eight (average, thirty days).

Several writers mention hamsters as susceptible.

Hagger states that surra runs a very chronic course in camels, and that the natives believe that a small portion of those surviving for three years recover. He gives as the principal symptoms fever, swelling on the right side of the chest, in the scrotum and sheath of males and in the udder of females, frequent abscess formations in these regions; progressive anæmia and rapid emaciation. The appetite remains good. Parasites are present in the blood during fever, and are absent during intermissions.

The several forms of the disease are said to run a chronic course, somewhat similar to that of the goat, in the deer.

COURSE, DURATION, AND PROGNOSIS.

The course of the disease varies in the same, and considerably more so in different species of animals. In the language of Laveran and Mesnil, "it always shows the general characteristics of blood infection."

A temperature of remittent, intermittent, or relapsing type is present in nearly all animals, including man. Progressive anæmia and emaciation are also constant manifestations. It is rarely a very acute infection, although in exceptional cases it becomes so intense as to suggest septicæmia.

The duration is also variable, both in like and unlike animals. Schilling says that the surra of South Africa lasts from thirty-six days to eight months in horses. He considers the acuteness of the disease to be influenced somewhat by the number of parasites in the blood. Bruce says that horses live for weeks and months with nagana.

In the Philippine Islands the duration of the disease in horses does not show a greater variation than it does in other countries. It is from fourteen days to three months, and is about the same for American, Australian, Chinese, and native horses.

The length of time the disease lasts in cattle is usually somewhat longer. Bruce had a cow sick with nagana under observation during eighteen months.

The prognosis is influenced to a certain extent by the species of the animal infected. Most writers agree that it is invariably fatal in horses, but there are some exceptions. Schilling believes that some horses recover; and Laveran and Mesnil say that recoveries have been reported in South America, although they have seen none. A varying percentage of cattle, according to careful observers, recover. Bruce says that cattle occasionally recover from nagana, and Laveran and Mesnil have had similar results. Lingard believes that a large proportion of cattle recover. Voges, on the other hand, considers the cattle of South America immune.

The annual report of the division of the chief quartermaster of the Philippine Islands for the year ending June 30, 1902, records the death of 3,693 horses and mules out of a total of 17,220 on hand. He adds that most of this havoc was produced by surra and glanders.

The course, duration, and prognosis of the disease have been considered somewhat in detail under the discussion of the different species of animals.

The duration, in particular, varies so much with environment, the constitution of the animal, and probably with other conditions which we do not understand, that it can not be fixed except within wide limits. The prognosis is always grave, the mortality in most species of animals being 100 per cent. The only exception to this fact among domestic animals of economic importance is found in cattle, a varying percentage of which recover.

COMPLICATIONS.

Broncho-pneumonia, observed especially in horses, has been mentioned by writers as a frequent complication. In this country œdema and congestion of the lungs is common, while broncho-pneumonia, more or less extensive in character, is occasionally seen.

Nephritis, hydropericardium, and hydrothorax sometimes explain unusual symptoms. Tuberculosis and surra are not infrequently associated, especially in monkeys. We have had two cases of surra and glanders in the same animals. Filariasis and surra often occur together in dogs. Rinderpest sometimes develops in cattle suffering with surra.

Other diseases which we have found associated with surra are foot-and-mouth disease, psuedo-actinomycosis, pseudo-farcy, malignant neoplasms, and at least two septicæmic conditions not fully understood.

DIAGNOSIS.

In order to carry into effect methods looking to prevention, an early diagnosis is very desirable in all cases. Fortunately in the horse, the most frequently infected of all animals, this is in the majority of cases easily done by a microscopic examination of the blood, which consists in examining a specimen prepared in the same manner as one to be examined for malarial parasites. The *Trypanosoma* are readily observed with a Zeiss DD or AA and ocular 4, and are usually in sufficient numbers to be quickly seen. In many cases, however, they may be so few as to require considerable time and the examination of several specimens before they are found; and, as has already been said, they may not be observed at all for several days at a time by this method.

When infection is suspected and parasites are not found in the blood there are two courses open: First, microscopic examination, carried on for several days if necessary, will usually suffice for making the diagnosis in horses and in several other animals in which the parasites are but rarely absent for more than a few days at a time in the early stages of the disease. The second course is to test the blood by animal experiment. For this determination any of the smaller animals, particularly dogs, monkeys, and white rats and mice, are satisfactory. A few drops to 1 c. c. of blood from the suspected animal may be injected under the skin, or preferably into the abdominal cavity, on account of the shorter incubation period, after which the parasites may be demonstrated in the usual way.

The objection to the latter method is the expense of the animal and the length of time necessary for the appearance of the parasites. On the other hand, results are certain, and in the case of some animals time is saved. This method, however, is absolutely necessary in many cases of infection in cattle, goats, sheep, and some other animals, and should be employed in all cases of doubt from any cause.

Whatever the method used, a determination of the blood infection is absolutely the only way to make an early positive diagnosis of the disease in any species of animal, and it is well constantly to bear this in mind in performing work which means so much in suppressing an epidemic.

As has already been said, the early clinical manifestations are slight. The temperature, always highest in the afternoon, is constant in most animals immediately after the incubation period, but may drop to normal again very quickly and remain so for days. When present during an epidemic it is significant, but its frequent absence leaves much to be desired. The next symptoms to appear are catarrhal discharges from the nose and eyes and a beginning pallor of the mucous membrane. Even with all these symptoms, which may not be fully developed for a week, the diagnosis is still not absolutely certain without a determination of parasites in the blood.

With the development of other symptoms, such as oedema and incoordinations, in addition to those already mentioned, a diagnosis upon appearance alone is justifiable.

DIFFERENTIAL DIAGNOSIS OF SURRA, NAGANA, DOURINE, AND MAL DE CADERAS

Very little convincing work has been done to solve this important question, for the reason that very few workers have had the opportunity of studying more than one of the affections. In most cases authors have contented themselves with the conclusion that, if not identical, they are closely allied. Koch, who worked particularly with surra and nagana, considered the parasites and the resulting infections identical, and many others have formed similar conclusions, while Voges, Laveran and Mesnil, and others maintain certain differences to exist.

Writing of nagana and mal de caderas, Laveran and Mesnil consider them distinct morbid entities, which can not be separated by their clinical symptoms, and they further maintain that species of animals which are susceptible to one can also be infected by the other. They classify their reasons for considering the two diseases to be distinct under three headings: (1) Constant morphologic differences between *Tr. brucei* and *Tr. equinum*; (2) animals immunized against nagana do not have for *Tr. equinum* the same activity that they possess for *Tr. brucei*, and (3) animals immunized against nagana are susceptible to mal de caderas.

The morphologic differences between the two *Trypanosoma* have already been considered, and regarding the other points of difference Laveran and Mesnil explain themselves in substance as follows:

A deer recovered from nagana at the end of eight months, and, having received during the interval fifteen inoculations of 10 to 60 c. c. of the blood of a dog affected with nagana without contracting the infection again, was inoculated in the skin with 1 c. c. of diluted blood of a rat suffering with mal de caderas. Blood taken from the deer five days after this inoculation was infectious for mice by intraperitoneal injection.

A sheep cured from nagana after a period of one month, and which had received during this time inoculations of 10 c. c. to 20 c. c. of blood from a dog suffering with nagana, was inoculated subcutaneously with 0.5 c. c. of diluted blood from a mouse sick with mal de caderas. The blood of this sheep obtained five days after the last inoculation and injected into the peritoneum of a rat (with a dose of 3 c. c.) and of two mice (with doses of 0.25 c. c.) gave to them an infection caused by the *Trypanosoma* of mal de caderas, with an incubation period of less than four days.

Blood taken again after fifteen days from mal de caderas and injected into the peritoneum of a rat and a mouse conveyed the disease with an incubation period of four to six days. The blood of a control sheep, which had not yet received an injection of *Trypanosoma* of nagana, examined on the fifth and thirteenth days after inoc-

ulation of mal de caderas, showed the same virulence as the blood of sheep recovered from nagana and infected with mal de caderas.

The question as to whether the serum of animals immunized against nagana is active for *Tr. brucei* and without action for *Tr. equinum* is discussed by Laveran and Mesnil as follows:

"I. The serum of a deer immunized against nagana, when given in a dose of 1 c. c. containing from $\frac{1}{10}$ to $\frac{1}{20}$ c. c. of blood of mal de caderas, showed no action on the incubation period or on the progress of the infection in mice inoculated with the mixture. The same quantity of this serum, mixed with corresponding doses of blood of nagana, prolonged the incubation period of the disease about five days.

"II. The serum of a sheep which had recovered from nagana, when given in a dose of 1 c. c., or even 2 c. c., mixed with doses varying from $\frac{1}{10}$ to $\frac{1}{20}$ c. c. of diluted blood of a dog having mal de caderas, had no action on the incubation period or on the progress of the infection in mice inoculated with the mixture. The same serum, in a dose of 0.5 c. c. mixed with $\frac{1}{10}$ c. c. of diluted blood of a dog, prevented all infection in the rats inoculated with this mixture. We also experimented with a mixture of 1 c. c. of the serum with 0.5 c. c. of the same diluted blood."

Bruce considers nagana and surra analogous, if not homologous, diseases. Weber and Nocard have concluded that surra, nagana, and dourine are the same disease, with slightly different symptoms. Schilling considers them all closely related or identical. Curry believes surra and nagana probably to be the same, but does not know with which to place the Philippine epidemic.

Salmon and Stiles state that the majority of writers consider surra and nagana the same disease, but that they maintain dourine to be different. Sivori and Lecler from their studies think that the parasites of surra and nagana are identical.

Voges will not venture a decision as to whether mal de caderas and dourine are the same disease. He points out in detail their great similarity. He considers these diseases different from surra for the following reasons:

(1) "Dourine and mal de caderas can not be transmitted to cattle, which animals are directly attacked by surra." (2) "In regions where mal de caderas exists cattle do not die from surra." (3) "We have no reason to believe that *Trypanosoma* show the same irregularities of virulence as bacteria, so that the different forms of the disease may be said to be produced by different degrees of virulence in the same *Trypanosoma*. On the contrary, during our four years of experimentation, the latter have shown a constant virulence." The fourth reason, which he considers decisive, is based upon the morphologic differences in the parasites, which have already been discussed. In conclusion he says, "I think these four proofs are entirely sufficient to establish for all time the difference between surra and dourine, as well as between surra and mal de caderas."

In another article Laveran and Mesnil give extensive consideration to the differences between surra and nagana, which in substance is as follows:

"The same animals are susceptible to both of them—the horse, the ass (except perhaps certain races), the mule, the goat (in the Dutch East Indies they are refractory to surra), the sheep, the cow, the camel, the dog, the cat, the monkey (long-tailed macayo), the rabbit, the guinea pig, and the rat. In the horse, the course of the disease is the same, whether surra or nagana. The animal dies at the end of the same time (thirty days on the average). In the case of experimental inoculation, the incubation period is the same, there are the same lesions of the eye and lids, the same œdema, the same degree of ænemia, the same emaciation, followed by final paresis preceding death. The fever is of the same type, except that it is perhaps more clearly intermittent in the case of surra; besides, during the intermissions, which may last from one to six days, the parasites are not seen in surra by microscopical examination, whereas they are very rarely absent in nagana. (Lingard insists particularly on this difference.) In short, the differences are minimum.

"The other equides—the goat, the sheep, and the dog—die of the two diseases in the same length of time and with practically the same symptoms. * * * Rabbits, guinea pigs, and rats (*Mus decumanus*) succumb to surra with about the same symptoms as nagana.

"Cows remain to be considered. Few survive nagana (according to Bruce, Koch, and African explorers in general). On the contrary, they generally recover from surra. According to Lingard, death from this disease is in fact exceptional. The animal becomes considerably emaciated, but recovers its health, and a second inoculation does no harm. This appears to be a sharply marked difference between the two diseases. Perhaps this is owing to a difference of race, as Rogers has supposed, recalling the experience of Koch relating to the asses of Massai. In any case, the question should be settled by experimental methods. If the supposition of Rogers is considered incorrect, the question may be determined by proving whether cows

inoculated with several doses of surra blood are susceptible to nagana. Not until these experiments have been made can a positive conclusion be given."

Mal de caderas.—Passing next to mal de caderas, Laveran and Mesnil believe that in most of its principal symptoms "it does not differ at all from surra and nagana, but hematuria is frequently present. Paralysis of the posterior extremities, * * * a marked symptom of the South American disease, * * * is undoubtedly more pronounced than in surra or nagana.

"The dog, the sheep, the goat, the cat, the monkey, the rabbit, the guinea pig, the rat, and the mouse succumbed at the end of various periods, according to the species of the animal (five to twelve days for the rat; four to eight days for the mouse; ten to fifteen days for the monkey, and three months or more for the goat and the sheep). In the rabbit the course is slow, and the animal presents the same symptoms of the eyes and genital organs as we have noted in nagana.

"Cows are absolutely refractory. Argentine scientists mention a bull which was inoculated every eight days for a year and a half with 200 to 300 c. c. of blood from a sick horse without showing any signs of the disease. They do not say whether an examination of the blood was made or a susceptible animal inoculated with it, especially during the month which followed the first injection."

In short, Laveran and Mesnil consider mal de caderas very closely related to surra and nagana.

Continuing this discussion with reference to dourine, Laveran and Mesnil say:

"We have already shown * * * that the *Trypanosoma* of dourine present morphological differences from that of nagana. This is an important argument in favor of the nonidentity of the two diseases. The etiology is completely different. Contagion by coition seems to be the only natural mode of infection for dourine, as no spontaneous cases are known in geldings and mules. Insects, then, play no part in the propagation of dourine.

"May nagana be contracted by coition? It is not probable, as no contagion results from depositing the virus on an unbroken mucous membrane. Nevertheless the experiment should be made, especially in the case of the rabbit.

"The first symptoms (in the horse) appear ten to twenty days after the infecting coition. * * * In the male there is edematous enlargement of the foreskin, then of the extremity of the penis, and a slight muco-purulent oozing from the urethral mucous membrane, which is inflamed. In the female there is an enlargement of the two lips, or of one alone, with a muco-purulent discharge from the inflamed vaginal mucous membranes.

"When this has persisted for a short time, other phenomena are manifested, as edema of the limbs and abdominal regions, progressive anemia, constant emaciation in spite of good appetite, weakness of the muscles, especially of the posterior extremities, and often sharp flexions of the joints. Certain symptoms are pathognomonic, so to speak, as the cutaneous patches seen on various parts of the body. There is hardly any fever; the temperature rarely passes 30° C.

"The disease generally lasts from four to ten months, and has never the acute character of nagana or surra.

"Toward the end of life ocular troubles (conjunctivitis, ulcerative keratitis) are sometimes noticed; the pareses are accentuated; there may be pronounced or very nearly complete paraplegia; and at autopsy foci of softening of the medulla may be observed, which is never the case in nagana or surra. * * *

"The common symptoms of dourine and nagana then are striking. As to the special symptoms of dourine (cutaneous plaques, foci of softening of the medulla), they are not constant (the cutaneous plaques, for example, generally being absent in the ass) and may be considered in accord with the slower course of the disease. Nocard 'has been able to kill horses in four, six, and eight weeks with a temperature curve identical to that which characterizes surra and nagana.'"

Considering dourine in their animals, they say:

"The dog, the rabbit, the rat, and the mouse are susceptible, but with exceptions and degrees of illness that show variations in the virulence of the infecting agent. * * * Rouget killed white mice in five to ten days with a general infection like nagana in its course. Only a small number of sewer rats succumbed, others recovered after having a sanguinary infection, while some were absolutely refractory. In the beginning of their studies, Buffard and Schneider had the same experience as Rouget on rats and mice, but Nocard, who after passage of their *Trypanosoma* through a dog, found rats and mice almost absolutely refractory, and it was only with the greatest difficulty that the virulence was sufficiently increased to make rats sensitive. In the rabbit and the dog the course of the disease is much the same as in the horse, and contagion may take place by coition.

"We wish to call particular attention to the lesions in the infected rabbit, already well described by the authors we have cited. They are much like those of rab-

bits infected with nagana. * * * With nagana, however, they never live longer than two months after inoculation, while in the case of dourine they may survive for more than six months with characteristic lesions. Experimental methods, therefore, do not show a sharp difference between dourine and nagana. * * * Cows are scarcely susceptible to surra and absolutely refractory to mal de caderas, the two diseases which we have shown to be so closely related to nagana.

"Finally, a recent experiment of Nocard shows that there is a difference between dourine and nagana, * * * which corroborates our morphological observations. A number of dogs highly immunized against dourine were inoculated with a very small quantity of blood taken from one of our mice and rich in *Trypanosoma* of nagana at the same time as a control. The two immunized dogs died of nagana in eleven days, the control in fourteen days."

The statement of Weber and Nocard and others that dourine is found naturally only in horses and donkeys has been used as an argument for the individuality of this disease. In looking over the work of these writers, however, it will be noticed, as has been pointed out by others, that their statements are based upon observations made in localities free from other forms of the disease, and in at least one case in a country free from the known insects of transmission. When dourine is transferred to a country where surra is prevalent, it has recently been shown that transmission takes place just as it does in this disease, so that it appears that Schilling's remark that coition is the natural mode of transmission only in the absence of the usual insects and other necessary environments, is rational, and goes a long way toward refuting one of the arguments for the individuality of this disease.

We have studied surra with special reference to the particular points brought out by writers in various other countries, and have been unable to find any clinical evidence that it is materially different from the description of any one of the other diseases, or that they differ sufficiently from each other to justify the continuation of so many names.

A comparative study of the *Trypanosoma* has already been discussed in a chapter devoted to that subject, and it is unnecessary to repeat conclusions here.

In summing up the whole matter it appears to us, when we take into consideration the work done by others and add our own results, that we are justified in believing surra, nagana, mal de caderas, and probably dourine, the same disease, and that all are caused by *Tr. evansi*.

We recently received from Java a cow suffering with surra when it arrived. Rinderpest also developed in this animal shortly after landing, and the surra not yet having been discovered, the blood of this animal was used by Doctor Jobling, director of the serum laboratory, in the immunization of three other cattle, two of which promptly developed trypanosomiasis. We have studied the parasites in these animals and the course of the infection in different animals, and have satisfied ourselves that it is the same disease with which we are working in Manila. If the transfer of surra from Java to this country causes such a change in the nature of the infection in cattle, it is not at all surprising that similar ones may be brought about by transferring it in other countries.

Laveran and Mesnil found that the parasite of nagana is not so virulent for their cattle in France as it is usually reported to be for those of Africa.

The immunization of animals against one form of the disease with attempts to prove them susceptible to another has been undertaken by several authors, and most flattering results have been reported; but on going over the work it does not appear that the presence of the first disease was disapproved by animal experiment in some of the so-called immune animals before the second one was administered.

A discussion of the very interesting and important question of the identity or difference of these various diseases, to be of any great value, must take into consideration two factors, (1) the morphology of the parasites and (2) their pathogenesis in full.

It is the old story of parasitic infections over again, the zoologist paying particular attention to the first of these considerations without full investigation of the second, and the strictly medical man doing the opposite.

In this case both points deserve careful consideration, but as the value of conclusions in sanitation and therapeutics are enhanced more by what the parasite does than by what it is, we acknowledge the pathogenesis to be of the greater importance, and shall so apply it in our discussion.

A number, if not all, of these diseases show a special tendency to lesions of the genitals, and if, as asserted, dourine is transmitted only by coition, this fact would serve merely to emphasize a symptom shown as a tendency in the others, and therefore does not place the diseases so far apart as might appear at a glance. Competent observers have shown, however, that in this disease, as in all others of trypanoso-

matic origin, the infection may be transferred by inoculation and the typical disease reproduced in this manner.

The supposed natural transmission of dourine only through coition has been explained by a recent writer as probably owing to the absence of the usual transmitting insects in the regions affected. In any event, it does not appear to have been demonstrated that insects are not capable of transmitting the infection. The other described characteristic manifestations of the disease—the peculiar skin lesions—are found by a careful review of literature not to be confined entirely to dourine and not to be constant in this disease, especially when produced by inoculation. So far, unfortunately, but little work appears to have been done with a view to determining the probability of transmission of the other forms through coition and the study of the disease so produced.

In the early reports on surra by Evans and others it was stated that the disease was very fatal for cattle as well as for horses, but in late years most of the writers say that these animals are somewhat more resistant, and that some of them recover. So, too, with nagana; in certain parts of Africa the disease is reported to be very fatal for cattle, but in other sections of that country and in other countries a greater resistance has been shown, and, as with surra, a certain number recover. When we look over carefully the literature relating to these diseases in cattle, we fail to find the marked differences so strongly emphasized by some authors as being diagnostic points in differentiating the two diseases, and, indeed, there are as great variations reported for the action of either of these diseases in cattle as there are reported for any two of the diseases in them, so that we are justified in concluding that there is nothing in the course of the various forms of trypanosomiasis in the same or different animals to warrant considering them distinct pathologic entities; in fact, the contrary would appear reasonable.

Absolute proof of the identity or individuality of these infections, as they exist in various countries, can be obtained only by importing infected animals for each individual disease into one place and carrying on their study under like environment. Until this is done we are inclined, as before stated, to regard surra, nagana, mal de caderas, and probably dourine as the same disease. This is a very interesting question and one which should be settled; but as far as providing means to combat the infection is concerned, a solution of this problem would not be likely to add anything of value. Means which prove efficacious for one form of the disease will probably do so for all.

SUSCEPTIBILITY AND NATURAL IMMUNITY.

A full discussion of this subject would involve a great deal of repetition, but owing to its importance in dealing with epidemics it will be briefly reviewed.

On the whole there is a most remarkable similarity in the degrees of susceptibility and immunity of various animals to surra, nagana and mal de caderas. There are individual differences; but it must be remembered that many factors contribute to such differences, since experimentation is carried on in various parts of the world.

Schilling mentions pigs as the only animals refractory to African surra; others, however, have shown that they may contract this disease, and they are considered to be susceptible to the other forms of trypanosomiasis as well. Penning says that the cattle of Java do not contract surra, while Schat considers them susceptible. The chronic course of surra and nagana in cattle and the reported natural immunity of these animals to mal de caderas are not sufficiently at variance to justify the statement that the difference is diagnostic.

Lingard considers buffaloes susceptible, but says they may recover from the infection. These results do not differ from those reported in relation to the same animals in other countries. He also cites the case of a horse which he cured of surra with arsenic, iodide of arsenic and mercury, but twelve months after the cure the animal died of the disease from the inoculation of one drop of virulent blood.

Sivori and Lecler were unable to find *Trypanosoma* in carpinchos, tapirs, peccaries, stags, small deer, pumas, tigers, and the *Lutra brasiliensis*.

Birds, according to Foa, are absolutely refractory to large doses injected subcutaneously, abdominally, or through the eye. Voges, on the other hand, claims that chickens, ducks, and turkeys are susceptible by inoculation to mal de caderas. Later reports state that the birds of South America are immune.

Voges believes that the cow is the only animal naturally immune to mal de caderas. He proved horses, mules, donkeys, sheep, goats, rabbits, dogs, guinea pigs, white and gray rats, and white and gray mice to be susceptible.

Rouget determined birds, bats, and guinea pigs to be resistant to *Tr. equiperdum*. Sewer rats also showed a partial immunity. Kanthuck, Durham, and Blandford consider the sheep and deer of Africa resistant to nagana; and Koch says that the asses

of Massai and the crosses of these asses with those of Mosket are immune to the same disease.

Salmon and Stiles mention horses, asses, mules, camels, elephants, cats, dogs, cattle, buffaloes, sheep, goats, rabbits, guinea pigs, rats (*Mus decumanus* and *Nesokia providens*), and monkeys as susceptible to surra. They say that birds, reptiles, amphibia, and fish are immune to the *Trypanosoma* of mammals. The gaur (Indian bison) and the tsaing, according to Evans, have never been observed to have surra.

Ducks, roosters, doves, sucking pigs, and kids (a short-legged variety of goat found in Toga) were inoculated by Ziemann, and recovered permanently from the disease.

Curry considers chickens immune by inoculation. He found horses, cows, carabaos, monkeys, dogs, cats, and rats susceptible to infection with *Tr. evansii* of the Philippines.

The only animals naturally susceptible to *Tr. lewisii* are wild and gray rats and mice; white rats and mice, and taches may acquire the disease by inoculation. Laveran and Mesnil, and others have shown that guinea pigs inoculated in the abdominal cavity are temporarily infected in a certain percentage of cases. To these may be added monkeys and puppies.

Rouget showed that white and gray rats and mice, rabbits, and dogs inoculated subcutaneously, intraperitoneally, in the abdominal cavity, or by dropping infected blood into the conjunctiva, are susceptible to *Tr. equiperdum*. Wasielewski and Senn found *Tr. equiperdum* in horses and asses, and successfully inoculated horses and dogs with it.

Voges mentions dogs, horses, rabbits, rats, mice, and guinea pigs as susceptible by inoculation to dourine. Weber and Nocard say that this disease may be inoculated subcutaneously, abdominally, or in the scrotum or vagina in the case of the dog, the horse, the donkey, the rabbit, and the mouse.

Bruce proved the horse, mule, ass, cow, dog, cat, buffalo, hyena, bobale, and several other animals susceptible to nagana.

Laveran and Mesnil mention among the animals which may contract mal de caderas horses, asses, mules, cattle, sheep, goats, rabbits, guinea pigs, dogs, cats, rats, camels, elephants, and monkeys. Brumpt found the chamois susceptible.

There is no doubt that cattle have a relative natural immunity, which seems to vary somewhat in different countries, but this variation is not great enough to be of especial diagnostic significance.

The value of keeping in view the relative immunity of certain animals, in addition to its scientific interest, lies in its practical significance in providing measures for the suppression of an epidemic. The animals showing this tendency in the greatest degree are those which also give the least physical evidence of infection, and consequently are dangerous in that they provide hosts for its perpetuation. It is in these animals that parasites are often present only in small numbers in the peripheral circulation, necessitating animal experiment fully to establish a diagnosis.

PROPHYLAXIS.

The question of prophylaxis constitutes the next important part of this subject. All efforts to cure the disease having failed, and there being but slight prospect of working out methods which will be successful in the treatment of an animal once infected, our highest hope lies in being able to bring about a practical and at the same time efficient condition of prevention.

A curative treatment of animals suffering with this disease is not at all necessary to the welfare of the community which has the infection in its midst. It is a disease belonging to the class readily controlled by preventive measures, just as the case with many of the infectious diseases of man for which we have no cure. Practical rules for the control, and even for the suppression of an epidemic, may be prepared and enforced with no great difficulty; and the failure to do so shows a lack of progress in proportion to that evidenced in the control of the less important diseases.

With the aggregate of the findings on the nature and mode of transmission of this disease before us, and considering the practicable manner in which this knowledge may be applied efficiently to control the infection, one can not help wondering that the annual loss of millions of animals from this scourge is permitted.

With the possible exception of rinderpest, it is the most important disease of animals with which a large part of the tropical world is infected. From an economic standpoint, measures looking to its control are of greater importance to the public welfare than are many of the diseases of man on which annually are spent millions of dollars.

Quarantine regulations governing the importation of animals are obviously the first point to consider in the discussion of preventive measures. Very few countries

have efficient quarantine laws. France prohibits the importation of animals from infected countries, and the United States does not allow animals to be imported from the Philippines. Recently a few other countries have been considering similar steps.

Laveran and Mesnil state that "the importation of animals from infected countries should be prohibited or greatly restricted. All animals arriving at a port should be examined and if any are found to be infected, these should be killed and the others isolated. If the disease gains entrance to a new country, preventive measures, if established early, should prove efficient."

In a preliminary report, Bulletin No. 3, bureau of government laboratories, Musgrave and Williamson in part say as follows:

"1. Prevention of reinfection of the country by proper quarantine laws.

"2. Eradication of the present infection by enforcing efficient sanitary regulations.

"It is believed that the methods to be described are practicable, and, if adopted, will prove sufficient to control the epidemic and eventually to eradicate it from the country; but to give the best results work should be begun at once, during the dry season, while the cases are comparatively rare and before the wet season comes with its great increase in the number of biting flies and the consequent spread of infection.

"Had vigorous methods been adopted when the disease first appeared in this country, in 1901, there would not have been an epidemic; and even now, were proper procedure followed persistently, the disease should be eradicated from the Islands. If, however, no more efficient course is adopted than the one in use now, the disease will go on spreading until the whole country is involved and the epidemic becomes perpetuated, as it has been in Africa, South America, India, and other countries.

"The subject is an all-important one to the country, and it is imperative that facts and suggestions as to remedies be placed before our legislators. Without legal authority, municipal sanitation (as history so well demonstrates) must always be a failure; but with the authority given by proper ordinances, a disease such as trypanosomiasis of horses should be controlled from the start and finally eradicated from any country in which it has obtained a foothold.

"In considering quarantine regulations against the introduction of trypanosomiasis into a noninfected country, a safe but hardly justifiable procedure would be to forbid the entrance of any animals from an infected port, as was so promptly done by the United States against the Philippine Islands when the disease was first reported here. Whether our home country enforces the same stringent laws against all others infected with trypanosomiasis and against all animals which have been in infected countries but are shipped to America from noninfected ports, can not, without full knowledge of the quarantine laws, be stated; but, granting this to be so, there still remain reasons for stating that there must be forces other than quarantine laws which prevent the introduction of trypanosomiasis into the United States. Wild animals for circuses and other purposes are certainly admitted in considerable numbers from infected countries, and when we consider the fact that many of these animals harbor the parasite without inconvenience, the introduction of the infecting agent into America at some time or other seems very probable. Not alone quarantine laws, but other factors, such as possibly conditions of temperature, moisture, and carrying agents, probably play a part in preventing the spread of the disease.

"However, trypanosomiasis has gained admission to the Philippine Islands, and, so far as we are concerned, there is no need of discussing the quarantine laws necessary to prevent infection in a virgin country. It would have been entirely feasible, as is shown by accumulated experience, to have prevented the introduction of the disease into the Philippine Islands, with its subsequent disastrous results, by the enforcement of proper quarantine regulations without actually prohibiting the importation of animals. That this was not done is owing to the fact that the disease was not recognized until after its introduction and to our inexperience in dealing with tropical conditions, but it would appear in place to sound a note of warning to other countries, especially those within the geographically infected zone and which are as yet without the disease. It is a question of economic importance second to none in a large area of the world, and deserves the closest attention and prompt action of the sanitary guardians of the public welfare."

In framing quarantine laws particular attention should be paid to wild animals and to circus animals in general.

It has already been shown in discussing the etiology and modes of transmission of the disease that every case of infection is entirely dependent upon exposure to biting insects, and that this brings us in the outset face to face with the necessity of (1) destroying all infected animals, (2) destroying biting insects, (3) employing a combination of these methods, or (4) rendering susceptible animals immune.

Before beginning a discussion of these points we shall review somewhat fully the recommendations of Voges, of South America, and Schat, of Java, who have written in detail upon this subject.

Voges considers preventive measures under two headings: General means and specific means. The burning of cadavers need no longer be recommended, since we know that twenty-four hours after death the tissues and fluids are no longer infectious. It is sufficient to protect the bodies from biting insects during twenty-four hours. When the disease breaks out in pastures, the animals should be transferred to high, dry, grounds, and those already infected should be killed. Animals should not be allowed to run at large, but should be kept in stalls; and especially valuable ones may be protected from biting flies by screens.

Voges compares mal de caderas to malaria in the manner of its spread, etc., and suggests preventive measures along the lines used for the latter. He states that there are two methods of preventing malaria—that of the Italian school, which bases its work upon the destruction of the intermediate host, and the other, that of the German school, as recommended by Koch. Continuing, he writes as follows:

"Quite different is Koch's system, which strikes the evil at its roots. Koch fights the cause of the disease, the plasmodium; he seeks to remove it, and in effecting his purpose does essentially nothing different from what has been done with considerable success in other infectious diseases.

"If I am working in the laboratory with a culture and wish to transmit it, I use a platinum point. If the platinum point is taken away from me, for the time being I can make no inoculations, for I must first make a new point. If, on the other hand, my cultures are taken away from me and every crack and corner where these might be is ransacked, and I am deprived of every possible opportunity to make a new culture, then my inoculations are at an end and I can not proceed with them even with the best of points.

"I always use this illustration when I wish to explain Koch's malaria theory. In malaria the mosquito serves as the point, and I no sooner kill thousands of them than hundreds of thousands again appear.

"The reagent glass, the holder of the culture, is the person; the nourishment (agar, bouillon, etc.) is the blood. R. Koch puts into the reagent glass (the human being) a disinfectant (quinine) and the culture is destroyed. If, then, I disinfect everybody who has been inoculated with the virus of malaria, all the cultures are destroyed, and no matter how much virus (blood) the point (mosquito) takes from the reagent glass (human being), the transmission of the disease is no longer possible. Could anything be simpler and at the same time more effective? Is it not, therefore, an outrage and a shame that even in our day civilized nations place their hands in their laps, at the most raising themselves to a few efforts, while they allow, their subjects to die before their eyes.

"Should not Koch's results, then, be applicable to mal de caderas? We know that the blood of horses suffering with mal de caderas harbors parasites. We know further that the infection is transmitted only through the bite of a blood-sucking insect. We also know that the infection occurs during times of rain and flood. And, finally, we know that the virus maintains its vitality in horses for from two to five months, and in donkeys and mules as long as one year, and can nearly always be detected during this time.

"In malaria the conditions are such that we must seek the proper host in the human being, and in the mosquito the intermediate host. In the human being the virus maintains its vitality for years, but in the mosquito only a short time. Evidently the conditions are very similar in mal de caderas. We have not yet discovered the intermediate host, but we presume that it is a blood-sucking insect, while the horse is the proper host. I draw this conclusion from the fact that in the case of the horse, and especially in that of the donkey and mule, sick animals are found throughout the year. Virus can be obtained at all seasons, although the disease occurs periodically, a fact which can be attributed only to the periodical appearance of the intermediate host (insect). With a knowledge of the intermediate host this would be still more evident, but for our object we really do not need this. Its periodical appearance is one of the most favorable preliminary conditions possible for a successful fight against the epidemic.

"We shall next state that there are certain periods, dependent upon the rains, during which the transmission of the disease through the intermediate host does not occur. The virus exists then only in the proper host. * * * The rainless season is the period of which we should take advantage to destroy the *Trypanosoma*, for it is then that their distribution is most confined.

"For our purpose we need only two things, first, a means of detecting the presence of the *Trypanosoma*, and, secondly, a disinfectant with which to destroy them. The second thing we do not yet possess, at least not one that will work in the same manner as quinine does in malaria. There remains only one possible solution, that is to destroy the *Trypanosoma* cultures; in other words, to kill the diseased horses.

"This measure is radical and yet very practicable, for such horses are of no value, and this is almost universally true with native horses, for when once sick, a horse may as well be considered lost, and it is useless to continue feeding him. Thus, if we have killed all the diseased horses, mules, and donkeys during the season which is free from the epidemic, when, with the beginning of the rainy season, the intermediate hosts return, there will be no more *Trypanosoma*, and the disease will at once have been stamped out, just as Koch exterminated malaria by poisoning the plasmodia with quinine. This is not only possible, but absolutely certain. It depends on searching out all the animals having *Trypanosoma*. If the rainy season were longer, most of the animals affected with mal de caderas, at least horses, would die. Donkeys and mules, however, would continue to live; but they show signs of weakness so early that it would be easy to pick them out and render them harmless."

Kimmerich, according to Voges, successfully combated the disease on his estate by converting the marshy regions into open ponds. He considered running water harmless. A South American company using a large number of horses lost annually the larger part of them for two years, the animals being kept in the fields, as is the custom there. Stalls were then built and the horses were kept and fed in them, as a result of which the epidemic disappeared. If infected herds are removed to high, dry grounds, the disease generally ceases. Horses quartered in stalls seldom contract it. The influence of stalling animals on the suppression of the infection is mentioned also by writers in India and Africa.

So far as we have been able to determine, Java is the only country which has adopted and enforced regulations for the suppression of the infection, and as a result the disease is well under control in that country.

Referring to the statement that it is impossible to destroy biting insects, Schat (Java) says:

"It is the opinion of Voges that blood-sucking insects are the carriers of the infection, but he has not proved it, probably because he considers the destruction of the insects as impracticable. Contrary to his opinion, we think it both desirable and possible to do so; nor is the measure to be left out of consideration. To search out all the hosts—that is, the animals suffering with chronic surra—is, in the Tropics, where sufficient expert assistance is lacking, not yet entirely feasible, the more so since Doctor Bruce, of South Africa, has found that the tsetse fly may become infected by sucking the blood of wild animals. The detection and destruction of all infected animals is therefore, under the circumstances, almost impossible in the Tropics. We should look for other measures, such as to insure the cooperation of the owners of cattle and, in general, of all laymen. We should make warfare on all flies found on horses and cattle.

"In the prevention of an epidemic of surra by veterinary means, the three following measures should, in our opinion, be particularly observed:

- "1. Limit the extent of influence of the flies which carry the infection.
- "2. Protect the sick as well as the healthy animals from the bites of flies in places infected with the disease.
- "3. Destroy the hosts—that is, the diseased animals—or else render them harmless.

"These measures alone should have a good chance of success, if the following rule of preventing the spread of an infectious disease at its first appearance is observed. The rule may be given as follows: Whenever an infectious disease appears, the cases of sickness and death should be reported as soon as possible. This applies to all infectious diseases in general, but it is particularly necessary in the case of surra, because its detection is often difficult and requires a great deal of time.

"Let us now, with special reference to surra, discuss the three above-mentioned measures, one by one, and with more detail.

"*First measure.*—To limit the extent of influence of the flies which carry the infection. Whenever a case of surra is determined by the clinical symptoms or by the discovery of *Trypanosoma* in an examination of the blood, or by animal experiment, the sick animal should first of all be isolated, or killed and buried. The animals which are kept on the same ground as suspects should not be transferred to any other place. In this way a spread of the disease as well as of the flies found on the animals will be prevented, for, as is known, flies swarm with horses and cattle when they are quickly removed.

"For the purpose of making it as certain as possible that no infected flies shall be transferred to other places in this manner, the transfer of cattle from grounds bordering on those where surra has been discovered, should be forbidden. This measure may, according to the circumstances, be extended to the entire inhabited part of a district or to a portion of it. In short we would recommend the prohibition of the importation, exportation, and transference of cattle, etc., in the inhabited part of a whole district or in portions of it.

"*Second measure.*—To try to protect the sick as well as the sound animals against the bites of flies.

"The sick and the healthy animals should be separated as quickly as possible and transferred to dark, spacious, well-ventilated stalls, since experience proves that in dark places, few, if any, flies are found.

"This precaution the inland cattle owner can take without great trouble. Furthermore, the greatest cleanliness should be observed in the stalls, although this would appear to be very difficult in the villages here, even with the greatest perseverance. The fecal matter should immediately be removed and collected in one place, not too close to the cattle stalls, in order to combat not only the flies but also the larvæ; we know that the larvæ of the *Stomoxys* live mostly in manure, where they develop into a light reddish-brown chrysalis, from which after from four to six weeks the young fly appears.

"It might, perhaps, be recommended that the leaves, pieces of wood, etc., found on the spot where a case has occurred be collected and burned. This should be done in the morning, on the wind side of the kraal, so that the smoke will drive away the flies, which appear on the animals just at this time of the day, in order to suck themselves full of blood.

"Whenever, in the rainy season, the smoking of the stalls in this manner becomes difficult or impossible, the same purpose may be accomplished by placing earthen or iron pans in them, burning damp wood, leaves, etc., in the containers; the cattle owner may also easily make use of ash water, with which he will be able to keep the flies from his cattle. In catching flies the inlander can, without much trouble, make use of sticky twigs; there will always be found on his ground a plant which produces one or another kind of gum or other viscous substance (getah). Getah, mixed with some kind of a treacle (tetes), smeared on a piece of paper or stick of wood, and hung up in the cattle stall, serves the purpose very well.

"*Third measure.*—To destroy or render harmless the hosts of the infection, i. e., the sick animals. * * *

"Thus far we are obliged to resort to a very radical measure, that of destroying the infectious material in as short a time as possible, i. e., killing the sick animals.

"On the outbreak of an epidemic of surra, so long as another and less costly measure is wanting, authority should be requested from the head of the provincial government to take possession of animals sick with the disease and to kill them, in the hope of checking its spread from the very beginning. If, however, too large a proportion of the animals have become infected, so harsh a measure could hardly be carried out; but we would suggest in that event that the spread of the infection may to a large extent be prevented by a strict isolation of animals in spacious dark stalls where great cleanliness is observed.

"I wish also to call attention to the following point: In the blood of emaciated animals we repeatedly found *Trypanosoma*, while clinically individuals suffer with emaciation for a considerable time, without showing, however, any other single definite symptom. It is just these animals from which a spread of the disease through flies should be feared, since we have been able to determine that whenever such chronic sufferers from surra die, their blood contains large quantities of parasites. In the eradication as well as in the prevention of surra it is therefore of great importance to know this fact, in order that the emaciated animals in the district may be looked after. Since this is so, and since in the examination of the blood of these animals surra parasites appear to be present, these hosts of the infection should first of all be rendered harmless.

"Our purpose is only to put these rules in such a form that they may best be applied to the purpose in view; that is, the prevention of surra."

Some of the earlier recommendations for the suppression of the epidemic in the Philippine Islands were not only unsatisfactory, but dangerous. Smith recommended isolation of sick animals at a distance of one-half mile.

Curry, in his original communication, recommended (1) the isolation (at least one-half mile) of infected animals, (2) the protection of infected animals from flies, (3) the protection of healthy animals, and (4) the keeping of flies out of stables. Early in 1902 proper advice in regard to measures for the control of the epidemic was given to the public by the government laboratories in a popular article in the Spanish press.

In a later publication Curry realized fully the weakness of his first recommendations, and made additional suggestions which, had they been followed at that time, would have resulted in the saving of millions of dollars to the country. In substance, these were the destruction of all infected animals and of as many flies as possible, and the protection of healthy animals.

Considerable delay in establishing rules which will control the infection here and which eventually will of necessity be adopted, has been occasioned by efforts to minimize the importance of the agency which flies constitute in the transmission of the disease and to push forward the untenable theory that food and water are infecting agents.

In the absence of any general plans and recommendations from the authorities, misguided local efforts have been made in communities, causing unnecessary expense and trouble and utterly failing to accomplish the purpose for which they were intended. Several municipalities have absolutely forbidden the use of native feed for animals and have promulgated long, useless rules for isolation, etc.

A set of rules which was adopted by one of the provincial boards of health and which was sent to us for remarks is as follows:

- "1. All sick horses must be isolated to a pasture separate from the rest of the herd.
- "2. Inspections must be made daily and sick horses transferred to isolated pastures.
- "3. The bodies of dead horses must be burned or buried in trenches at least 10 feet in depth.
- "4. Those who attend to diseased horses must not take care of other horses.
- "5. No efforts must be made to preserve the hides of diseased horses, for their sale will not be permitted.
- "6. The pasture used for diseased horses shall not be used for other horses or cattle for a period of two years after the epidemic.
- "7. Diseased horses shall not be watered in running streams, nor shall they be bathed in streams or rivers used for other horses."

Of course such rules need no comment. They show, on the other hand, that the intelligent element of the country is aroused to the necessity of doing something, and not knowing just what is best, follows out the dangerous suggestions of the earlier writers in regard to the epidemic in these islands. These are, however, in substance the antiquated ones of literature. In the face of all this it behooves us to reach the root of this subject for the information of the better classes, and to suggest regulations which will place the execution of efficient measures in the hands of the proper officials.

We have already dealt with the methods for preventing infection in a virgin country and reinfection in countries where the disease is already prevalent, and will now take up the discussion of methods looking to the control and suppression of surra in our own country. To be fully efficient, recommendations must, of course, be practicable and of such a nature that the cooperation of the public may be obtained. The necessary considerations are:

1. The destruction of all infected animals—
 - (a) Animals of economic importance.
 - (b) Rats and mice.
 - (c) Game and other wild animals.
2. The destruction of biting insects.
3. The protection of contact animals from flies during the incubation period.
4. Miscellaneous measures.

First.—The destruction of all infected animals would make other measures unnecessary; but this offers so many difficulties, especially in the provinces and outlying districts, that it will be found advisable to reinforce this measure by the other methods discussed.

(a) *Animals of economic importance.*—In Manila and other cities with organized sanitary corps diseased animals should be located without any difficulty. To do this to the best advantage and to make the work systematic necessitates that the whole matter be placed in the hands of a single bureau, and that bureau should of course be the insular board of health. Other points in the accomplishment of this task are matters of detail, which may readily be solved by the board of health. There can be no question that this matter properly belongs under the control of the sanitary bureau, just as do the infectious diseases of man. In fact, as already shown, there have been 16 cases of trypanosomiasis in man and the chances are that many more will be found.

The work of detecting all diseased animals will necessitate some kind of a systematic inspection, which may easily be carried out in Manila and other cities by those charged with such duties in guarding the public welfare. In addition to the daily inspection by sanitary inspectors of all horses found in stables, all other officials, such as medical, veterinary, and police officers, might be required to report all sick animals coming under their cognizance to an official of the board of health.

How best to secure the cooperation of the general public in reporting sick animals is a problem open for discussion. Several officials interested in this work have suggested the advisability of the government's buying all sick animals, arguing that a reasonable offer would cause all such to be brought in and thus prove economical in

the end, whereas, if coercion were attempted, the more ignorant people would hide their animals for days and probably for weeks before they could be found by the authorities, thus adding materially to the spread of the disease. This argument has something in its favor, but it seems to us on the whole a dangerous policy—the purchase of good citizenship—which, although it might give immediate results of a temporary nature, would in the end prove unsatisfactory. The purchase of superstition or malice, whether it be with candy in the case of children or with money in that of adults, and whether in the schoolroom or in the municipal office, invariably leads to disaster.

It appears to us that the recommendations made should be just and equitable, and such as will be supported by the intelligent part of the community and in the end will result in the elevation of the standard of citizenship of the ignorant. Undoubtedly right demands the cooperation of the public in such an undertaking, and we believe that the law should require owners, agents, and custodians of animals to report those sick and that the failure to do so should be punishable by law.

The manner and time of inspections and the reporting of sick animals in cities are matters of detail, which need no discussion here, while rules applicable to the provinces and outlying districts may be drawn up to meet conditions. The methods best adapted for searching out the infected animals may be subject to discussion, but the disposition of them when once found does not admit of argument. There is only one thing to do with a horse suffering from trypanosomiasis, and that is to destroy him immediately. To do this efficiently and quickly necessitates the placing of authority in such a manner as to avoid the loss of time.

Immediately after the death or destruction of an animal suffering from this disease, the body should be protected from flies, and other insects, and disposed of as soon as possible. This may be done in one of several ways. In cities, probably the most satisfactory way is to take the body to the crematory in a fly-proof wagon and have it burned at once. Where means for such disposition are not at hand, which is generally the case in rural districts, the body may be buried at a sufficient depth to keep dogs and flies away from the carcass for forty-eight hours, or it may simply be protected by mosquito netting, or otherwise, for the same length of time, and then disposed of in any sanitary manner.

It is well to call attention to the care which should be exercised in performing necropsies on animals dead of the disease. This should either be done under protection from flies, or, if this is not practicable, all living animals should be removed from the immediate vicinity and kept away for forty-eight hours. In any event, the blood, organs, etc., should be protected from flies and dogs, in the same manner as the whole body, for from twenty-four to forty-eight hours.

(b) *Destruction of rats.*—There is no longer any doubt that a certain number of these pests harbor *Tr. evansii*, and that they have a practical significance in the spread of the disease. The annual destruction of thousands of them in Manila, on account of the plague, as already mentioned, will no doubt reduce the danger of the spread of surra from this cause to a minimum. In the provinces, and cities, however, where this wholesale destruction is not carried on, the importance of looking after this work with especial reference to surra is more urgent.

Fortunately, whether in the city or in the country, great difficulty is rarely experienced in destroying large numbers of rats by poisoning; and it is recommended that such a procedure be carried out as a matter of routine in methods adopted for the control of the disease under discussion.

(c) *Destruction of game and other wild animals.*—In other countries, the spread and perpetuation of the infection is undoubtedly carried on by wild animals, and if our work in stamping out the infection here is not prompt and vigorous it will in all probability become one of the conditions that we shall have to face here later on, if it does not already exist to a limited extent. This is a matter to be kept constantly in mind in dealing with this disease, and our plans might well be broad enough to cover this point. This source of danger will, even under the most favorable conditions, rarely become a great menace in cities, but some precautions are nevertheless necessary.

A law which will prevent the reinfection of the country by such animals is of the highest importance. With the prohibition of the admission of circus and other wild animals, except under certain regulated conditions, there still remain for consideration the public animals of our parks. While the disease is constantly prevalent in Manila there is nothing to prevent some of the animals in the Zoological Garden from contracting it, and on account of the harmlessness of the infection in these animals, they might become an indefinite focus for the diffusion of the disease. It seems to us that the easiest and most practical way of avoiding this danger would be to inclose all such animals in fly and mosquito proof screened areas, as is now being done in many of the large zoological gardens in other countries. Researches of

recent years have shown the necessity of this precaution, since many wild animals act as hosts for other parasitic diseases communicable to man, which need not here be discussed.

2. *Destruction of stinging and biting insects.*—As has already been stated, if the destruction of infected animals (the hosts) were carried out systematically and with thoroughness, flies and other insects as carriers of the infection would be harmless. While we have sacrificed the ideal in the disposition of infected animals to the practical, as far as possible within the limits of efficiency, we fully realize that conditions may make still further sacrifices necessary. It is principally for this reason that we have taken up the consideration of auxiliary measures to supply what may necessarily be lost in the efficiency of the more desirable ones.

Insects are becoming of so much importance in the propagation of other diseases, both of man and of animals, especially in the Tropics, that we are urged to recommend their partial destruction on account of surra with more assurance, knowing that the fulfillment of our hopes would be a distinct step in advance in preventive medicine in general.

To illustrate what we shall some day be compelled to face here, the best medical thought of Europe and America is already concerning itself with the effect which fast travel to the Orient is likely to have upon the introduction of yellow fever to this part of the world. The proposed interoceanic canal has brought this subject afresh before the world. The mosquito of yellow fever is one of the most common in the Philippine Islands, and with the shortening of the voyage from fever-infected countries by the proposed canal, and, for that matter without the canal, by the increased speed of our modern ocean-going vessels, the time required to travel from those countries to the Orient will be brought within the limit in which the disease may be transmitted. Without dealing further with present and prospective problems, depending, to a certain extent, upon the disposition of certain insects for their solution, we shall resume the discussion in hand.

The most important insects to be destroyed, because of the part they play in carrying surra, are the biting flies. To accomplish this in the most extensive manner, and with the least amount of work, resolves itself into the destruction of their breeding places by the proper disposition of fecal matter. As has been recommended by various writers, this may best be done by burning all offal during the dry season. Methods upon a smaller scale looking to the same end are too well known to need discussion here. Cleanliness around livery stables and large corrals belonging to the government and to other persons is particularly desirable, because it is naturally in such places that the danger is the greatest on account of the close proximity of the animals and the large number of flies usually found there.

Recommendations and methods for the destruction of mosquitoes are so recent and so well known that this part of the subject may be omitted.

The destruction of fleas, which are second in importance to flies in the transmission of surra, is, so far as we are informed, an unsolved problem.

3. *Treatment of contact animals.*—The blood of an infected animal is infectious before the symptoms are present, or parasites found in the blood by microscopic examination, so that the necessity of protecting contact animals during the incubation period of the disease is evident.

There are several ways of accomplishing this. When surra is found in a stable, contact animals should be quarantined where they are, for at least seven days. The diseased horse, after removal, should be protected from flies during the first forty-eight hours, and if several are present they should be protected from each other. Where there are only one or two diseased animals, they may be protected by mosquito bars, by smearing with iodoform ointment, washing with solution of creolin, burning smudges in the stables, or by other well-known methods. Where there is a large number, as in a livery stable, it will be found easier to destroy or remove the flies by smudges, darkening of the stalls, etc.

All rats around such places should be poisoned and the general sanitation, especially with reference to breeding insects, should be improved.

Temperatures of all contact animals should, of course, be taken twice daily during the incubation period, and the animals should be carefully examined for other symptoms. It is hardly necessary to repeat here that as soon as an infected animal is found it should be destroyed.

4. *Miscellaneous measures.*—Musgrave and Williamson, in a preliminary report, offered the following suggestions to owners of private stables or individual horses.

"When using the animals in the daytime, as much as possible avoid allowing a horse to stand in a group of other horses. To illustrate: Only a few days ago, we observed standing in front of a Government building some thirty or forty horses, and one of them, hitched to a public carromatta, had a well-advanced case of trypano-

somiasis. Should such a thing happen during the season of biting flies, the danger of infection to all would be very great.

"Stables should be kept scrupulously clean and well ventilated and excreta and waste should be promptly removed.

"All sores of whatever character on horses should be kept covered with a suitable ointment to keep off the flies.

"Especially valuable horses may be provided with screened stalls.

"There is no conclusive evidence, so far as trypanosomiasis is concerned, of any danger from allowing horses to drink the city water or to eat food supplied in the Manila market.

"Upon the appearance of illness in a horse a competent observer should be asked to examine the animal."

All kinds of sores on animals should be kept covered with tar, iodoform ointment, or some other substance disagreeable to insects. The legs and edges of the hoofs should be carefully looked after. Rats should be kept away from stables by systematic poisoning or should be caught with traps. Other little points worth looking after will suggest themselves to the thoughtful mind.

That from which the public in general will derive the greatest benefit, and which will give results to every stock owner, is the moral support of the officials intrusted with the handling of this problem.

SERUM THERAPY.

In this day of scientific advance in medicine, the trained mind naturally turns to the possibility of preparing prophylactic or curative sera for disease, and as all other remedial measures have proved a failure in surra, this seems to be the only hope. Considerable work in this direction has been done during the past few years, and while as yet not successful, the outlook is not altogether discouraging.

Koch professed to have established a successful method of preventive inoculation based upon the attenuation of the parasites by successive passages through other animals. His experiments are given as follows:

"On the 8th of September, 1897, there were inoculated with the defibrinated blood of an ox, rich in *Trypanosoma*, the following animals: One ass of Massai, one cow, two calves, two monkeys, two guinea pigs, two rats, and one dog. The ass of Massai, the monkeys, and the guinea pigs remained in good health; no sign of infection was observed in them. The cow died at the end of thirty-nine days, the calves at the end of forty-one and forty-nine days, the rats at the end of thirty-four and fifty-two days, and the dog at the end of nineteen days.

"On the 15th of October, 1897, the blood of one of the rats inoculated on the 6th of September was injected into two rats and one dog. One of these rats was found dead six days after inoculation, showing the appearance of *Trypanosoma* in the blood; the second rat showed *Trypanosoma* thirteen days after inoculation but did not die until sixty-eight days thereafter. The dog died at the end of forty-two days, and its blood was utilized for the third passage.

"On the 30th of October there were inoculated with the blood of the dog, two dogs, two oxen, four asses of Massai, and three rats. The dogs died after nineteen and twenty-six days, the rats at the end of sixty-seven, seventy-three, and eighty days; and the asses were not infected."

Laveran and Mesnil criticise Koch's work, stating that a certain percentage of cows are known to recover from both nagana and surra, and that the attenuation of *Trypanosoma* by successive passages through different species of animals is very slight.

Nocard immunized a calf that had recovered from nagana with increasing doses of virulent blood until it had received 850 c. c. in all. The animal was then proved free from infection by animal experiment, but its serum had neither preventive nor curative properties in mice, and mixed with infected blood produced the disease with a prolonged incubation. This serum was very agglutinative for *Trypanosoma*.

Rost gave a pony sick with surra 10 drops of normal goat blood subcutaneously, and 10 more drops four days afterwards in the same manner. A temporary diminution of the parasites and a fall of the temperature followed each injection.

Another pony, which had the disease in an advanced form, was given 20 drops of mule's blood by subcutaneous injection. The parasites temporarily disappeared, but returned in greater numbers, and the animal died on the fifth day after inoculation.

Another pony infected with surra, and the blood of which was rich in *Trypanosoma*, was given subcutaneously 30 drops of the blood of a goat which had recovered from a single injection of surra. The parasites temporarily disappeared. Another injection was given on the twenty-third day, and a temporary disappearance of the parasites again resulted. On the twenty-eighth day the parasites were again numer-

ous, and another dose of goat serum, which had been highly fortified by injections of surra blood, was given, followed by another fall of temperature and the permanent disappearance of the parasites. The animal continued to grow fat, but on the twenty-third day after the last injection the temperature again rose, and death finally occurred from tuberculosis.

Sterilized filtered goat serum caused a temporary disappearance of the *Trypanosoma* in a horse sick with surra, but the disease followed its regular course and the animal was shot before death. Ten mules were treated with serum without encouraging results; in fact, the contrary was true, for Rost concluded that the sterilized serum of immunized goats produced exacerbations of the disease in mules.

His best results were obtained from normal or slightly fortified goat's serum, for the more highly he immunized his goats the worse were the results obtained. He immunized a goat with surra blood taken from the same species of animals which he afterwards treated with the serum, and during a period of eight days he sterilized it daily for four hours at 57° C. He says that the immunized goat's serum killed surra parasites under the microscope.

Voges inoculated a cow for eighteen successive months with virulent blood, but the serum obtained from the animal was worthless, either as a preventive or curative.

In Schat's work the serum obtained from cows which had recovered from surra was injected into other cattle and into rabbits, and in some cases it seemed to exercise certain preventive and curative influence on the disease.

He immunized a cow against *Trypanosoma* by increasing doses of defibrinated blood during a period of two months. The serum obtained from this cow was injected in doses of 10 c. c. into two calves known to be nonimmune. Twenty-four hours after the last injection of serum the animals were inoculated with surra blood. A control was inoculated at the same time. On the sixth day parasites appeared in the blood of all the three animals, disappearing from that of the immunized calves at the end of four days and from the control at the end of five days. The protected calves returned to health, but parasites again appeared in the case of the control, and the latter went through the regular course of the disease.

A rabbit was protected by 5 c. c. of the same serum, with only a temporary appearance of the parasites. Three rabbits were inoculated with mixtures of cow's serum and blood containing *Trypanosoma*. One of them developed the disease, while the other two, where the mixture was kept for five to fifteen minutes before injection, did not contract the disease.

Laveran and Mesnil, experimenting mostly with mice and rats and a few dogs, state that human serum injected in sufficient quantities shows manifest action on the disease. *Trypanosoma* disappear from the blood at least temporarily, the evolution of the disease is retarded, and sometimes a complete cure results in the case of mice and rats. The serum of adults is more active than that of children and maintains its activity for a considerable time when preserved aseptically. Pleural effusions are less active than the serum from the blood, while the activity of ascitic fluid is still less. In infected mice they used doses of 0.5 to 1 c. c., and in rats doses of 1 to 2 c. c., which caused a disappearance of the parasites in eighteen to twenty-four hours after infection.

They had four successful cures out of a very large number of rats and mice so treated, and in all of these cases it was obtained after one or two injections. In those animals from the blood of which the parasites disappeared only temporarily, they were caused to disappear time after time by repeating the injection, and if they recurred after the first injection a complete cure was never produced.

By alternating the injections of human serum with arsenic the influence exercised on the longevity of animals was still more favorable, but there were no complete cures. One rat so treated lived for one hundred and twenty-seven days and a mouse for one hundred and three days.

Human serum was determined to be just as active for mal de caderas as for nagana, but *Tr. lewisi* was unaffected by the treatment. The sera of birds, chickens, and geese, highly fortified with *Trypanosoma* blood, had no curative power. Large numbers of sheep, cows, and deer recover from nagana, but their sera fail to show either preventive or curative properties, and do not acquire them when immune animals are further protected by large doses of virulent blood.

According to these authors, sheep, deer, and cattle which have recovered from nagana possess an active immunity to this disease.

Human serum has a very weak preventive power. Mice given 1 c. c. of blood mixed with 4 c. c. of human serum show no infection. Sometimes this result may be obtained by injecting serum and blood simultaneously in different parts of the body. If, however, the serum is given twenty-four hours after the virulent blood, the disease appears, the only result noticed being an increase of from five to nine days in the length of the incubation period. If human serum is injected first and

infected blood twenty-four hours later, the infection, as before, takes place with a prolonged incubation. In those mammals which do not contract the disease by the injection of human serum and infected blood an active immunity is established.

The sera of dogs, sheep, deer, horses, geese, and chickens, when mixed with trypanosomatic blood, are still infectious, and the disease runs the regular course with a normal incubation. The sera of animals that have recovered from nagana are without value as either preventive or curative agents in the disease. The serum of sheep which have recovered from nagana, and have afterwards been further immunized, shows neither preventive nor curative properties. Fortified sera from the chicken and the goose are worthless as a means of prevention. Chicken's serum mixed with equal parts of infected blood killed a mouse in fifteen days, while a control lived for seven days.

Strong, commenting on Laveran and Mesnil's work, writes: "We had already previously tried injections of human blood into monkeys suffering from experimentally produced trypanosomiasis from injections of *Trypanosoma evansi*, but found, while the parasites disappear temporarily, after a few days they were always again present in the circulating blood. Goat's blood and bile from monkeys that had died of the disease were also tried, but with like results. Goat's serum was used, as these animals are relatively immune to the parasite. Experiments with the intravenous injection of benzoyl-acetyl peroxide will be performed as soon as the animals for experimental purposes can be secured."

Laveran and Mesnil also showed that infected blood kept on ice or at the temperature of the room until the death of the parasites has almost resulted, is still infectious, producing no change in the course or the duration of the disease, excepting a prolongation of the incubation period. Similar results were obtained with blood heated to different temperatures for different periods of time. The addition of toluidin blue to infectious blood, in the proportion of 1 to 100 parts, did not modify its virulence, except to prolong the incubation.

They passed *Trypanosoma* through sheep six times and then through a dog, but the blood remained just as virulent for rats and mice as the original control. They failed to confirm Schilling's and Koch's work. The difference in action between their *Tr. brucei* and that of South Africa may be owing to the difference in species of the cattle or to an attenuation of their virus. They suggest the possibility of obtaining practical good by infecting the South African cattle with the milder *Tr. brucei* from which a large percentage of Paris cattle recover.

Laveran and Mesnil come to the conclusion that all attempts at prevention or cure have, for practical purposes, been negative, and that prophylactic measures which may be found of service in one form of trypanosomiasis will probably prove equally efficacious for all.

Schilling states that he attempted to attenuate the parasites by passing them through different animals. He inoculated three horses with *Trypanosoma* which had passed through five dogs. They all contracted the disease and died. He then inoculated two horses with *Trypanosoma* after eight passages through dogs, as a result of which they both contracted the disease and died. Parasites which had been passed through four cows were still virulent for the horse.

In a second paper Schilling writes that he immunized a bull which had recovered from surra. Parasites were found in the blood from nine to twelve days after the first injection of 10 c. c., but none were found after the second of 19 c. c., which was given in the abdominal cavity a month later. A month after this injection the serum in thirty-one minutes killed the parasites in the hanging drop. Further immunization for two and one-half months did not make it more effective in vitro, and when employed in treatment it was useless. After about eight months the animal died of hemorrhagic enterocolitis, but *Trypanosoma* were not present.

Schilling simultaneously inoculated three calves with the peritoneal exudate of a dog which had been infected by an abdominal inoculation of *Trypanosoma* after they had been passed through the peritoneum of other dogs. After twenty-one, twelve, and fifteen days, respectively, parasites were no longer found in these calves. The serum showed no reaction with *Trypanosoma*. These animals were then transferred to an infected region, one dying during transportation, while the other two were well at the end of three months.

The same author immunized a steer in a similar manner, except that as a first inoculation the peritoneal exudate of a dog inoculated directly from a horse was used, and a like injection was given sixteen days after the first. Five days after the first injection the serum showed no reaction with the *Trypanosoma*, but four days after the second one it agglutinated them, only a few motile ones being left at the end of thirty minutes.

Two young steers were immunized with doses consisting of from 3 to 10 c. c. of the peritoneal exudate of dogs which seven days before had been inoculated in the

abdominal cavity with virulent blood. On the fourteenth and fifteenth days after the last injection the serum of both these steers showed marked antiparasitic action on the *Trypanosoma*, killing them in thirteen to twenty-five minutes. Parasites were absent in both of these animals.

Schilling later immunized 36 cattle with the peritoneal exudate of dogs which had been given intraperitoneal inoculations of *Trypanosoma* attenuated by passing them through 7 dogs and rats and then through 18 to 21 dogs. The peritoneal exudate of dogs used on cattle always showed numerous *Trypanosoma*.

Of 24 cattle 12 showed parasites in the blood on the tenth day after inoculation. The number in all of these cases, however, was very small, and in 10 animals they disappeared in from one to two days. In one out of nine cows one *Trypanosoma* was found in a preparation made on the ninth day after the second inoculation, while the others were negative. The temperature rose to 40.3° C. on the fifth day after the first injection in the case of one of these animals, but it fell to normal within three days. On the same day a single parasite was seen, but after that none were to be found; indeed, following the second injection of large numbers of *Trypanosoma* the temperature remained normal and parasites were constantly absent from the blood.

Eight of the animals previously used were examined (subsequently to the last injection) to determine the parasitocidal power of the blood serum. In five cases the parasites were killed in twenty minutes, in one the reaction was very weak, while in two there was no reaction whatever. What the factors in the production of such differences were, he could not then say because of the limited time and the small amount of material at his disposal; he believed, however, that the cause lay neither in the quantity of injected parasites nor in the time which had elapsed between the first and second inoculations.

Of the animals used 19 remained in Sokode, 9 were taken to the station of Ataxpane, and 8 to Mishohe and the experimental station of the cotton expedition of the Colonial Scientific Committee in Tove—all places at which during the year before animals had died of surra. According to reports, at the beginning of October the inoculated animals were well, and in Tove 5 oxen were doing their usual work in the fields. The time had not been sufficiently extended for him to come to any definite conclusions.

In Sokode, Schilling found a naturally infected ass, which he watched for twenty-five days. It has already been stated that the ass of Soudan is susceptible to surra. Attention should here be called to the fact that there are some racial differences between these asses and those of East Africa with which Koch worked, and which he did not succeed in infecting. In one of his experiments, however, the inoculation of surra blood into a small wound in the skin of the ear proved negative. Passages of blood taken from the naturally infected animals mentioned above were made through several asses by the subcutaneous injection of large doses. Altogether 5 animals died between the eleventh and fifteenth days after inoculation, with all the symptoms of a severe general infection (fever of remittent type). Post-mortem showed nothing that might be called typical. The parasites increased very rapidly (incubation about four days), reaching enormous numbers. From this we may conclude that the Soudan ass is even more susceptible than the horse.

This writer inoculated the parasites obtained after passages through 5 asses into a small, healthy horse. The animal suffered an acute attack of surra, but the course was somewhat unusual. According to a letter received from Doctor Kersting, the animal was fairly well on the twenty-first day after inoculation. On the eighteenth day no parasites could be found.

He believed that the principle of successfully immunizing animals against the African tsetse-fly disease (nagana) had been discovered. The peculiarities of the nagana parasite with reference to its ever-present host, were utilized in weakening its virulence for certain kinds of animals.

In looking over literature carefully one is struck by the relative immunity to surra of certain animals that are susceptible to other diseases.

Mr. Harford, His Britannic Majesty's consul to the Philippine Islands, informs me that when he was stationed in Africa it was a recognized fact that "salted" animals were less susceptible to the bite of the tsetse fly than others, and that the Government paid increased prices for such animals for the African service. By "salted" horses are meant those that have recovered from a peculiar disease of horses prevalent in Africa, and by "salted" cattle those that had recovered from rinherpest.

G. H. Evans, quoted by Lingard, says: "The gaur (Indian bison) and saing suffer from rinherpest and foot-and-mouth disease, yet these animals have not up to the present time been observed with surra, although a careful search for the disease has been made. They live in a jungle where the flies are so annoying to them that they have to go into the open to escape their attacks."

In India a large percentage of cattle are "salted," that is, they have recovered from rinderpest or from the "serum simultaneous inoculation method" against rinderpest, which when successful results in a mild attack of the disease.

These points, and the fact that the injection of rinderpest blood into dogs prolongs the incubation period somewhat, suggest a possible antipathy between surra and rinderpest. We have performed a number of experiments fully to determine this matter, and have come to the conclusion that animals suffering from rinderpest or recovered from it are just as susceptible to surra as others.

The attempts of Schilling, Koch, and others to attenuate the parasites by methods already described, in which they believe they have succeeded, have been repeated by us, but we have been unable to verify their conclusions. In fact, we have failed to attenuate *Trypanosoma* by any of the methods employed. Attempts of all conceivable kinds have been made to immunize animals, but usually without success.

In the beginning of our work, when we were less familiar with our subject, we believed that we had immunized a goat, because parasites could not be found in the blood; but it was later discovered that the blood was infectious by inoculation.

We have succeeded in bringing a cow up to the point where the injection of 3,000 c. c. of blood produced but little effect, although it contained large numbers of *Trypanosoma*. This animal was infected and ran a chronic course after the first injection of 10 c. c., and the blood remained infectious until about one month after the last injection of 3,000 c. c.; but since that time, now three months ago, the blood of this animal has not been infectious by inoculation, and it has fattened and appears to be in perfect health. Serum taken from this cow at different times has been absolutely valueless either as preventive or curative in several species of animals.

Similar negative results have attended all our extensive work. We have followed the suggestions of others and have conducted many original experiments, but we have had no results which seem to offer hope for either a preventive or a curative serum.

TREATMENT.

Many drugs have been used in attempts to cure this disease, but so far without results offering any hope for future work along this line.

Braid, in a letter written in 1858 to the British Medical Journal, suggested the use of one to two grains of arsenic daily in cattle suffering from the bite of the tsetse fly. This letter was called to the attention of Dr. Livingstone, and he agreed to follow out the suggestion at the next opportunity.

In a letter to the British Medical Journal, published March 13, 1858, Balfour indorses Braid's suggestion as to the use of arsenic, but recommends Fowler's solution as a more desirable preparation, provided it is used in large doses.

Referring to the letters mentioned, Livingstone himself writes in the British Medical Journal, May 1, 1858, as follows:

"The very same idea with respect to the employment of arsenic in the disease which follows the bite of the tsetse occurred to my own mind about the year 1847 or 1848. A mare belonging to Mr. Gordon Cumming was brought to Kolobong, after prolonged exposure to the bite of the insect, and, as it was unable to proceed on the journey southward, its owner left it to die. I gave it two grains of arsenic in a little barley daily for about a week, when an eruption resembling smallpox occurred. This induced me to discontinue the medicine, and when the eruption disappeared, the animal's coat became so smooth and glossy that I imagined that I had cured the complaint; for after the bite is inflicted the coat stares as if the animal were cold.

"The mare, though apparently cured, continued lean. This I was rather glad of, as it is well known between the latitudes of 20° to 27° S. that when a horse becomes fat he is almost sure to be cut off by a species of pneumonia commonly called 'horse sickness.' About two months after this apparent cure the coat began to stare again, but this time it had remarkable harshness and dryness. I tried the arsenic again, but the mare became like a skeleton, and refused to touch the barley. When I tried to coax her, she turned her mild eye so imploringly, and so evidently meaning, 'My dear fellow, I would rather die of the disease than of the doctor,' that I could not force her. I got her lifted every morning to feed, and saw her at last perish through sheer exhaustion, and this was nearly six months after the bite was inflicted."

Since that time the treatment of trypanosomiasis by arsenic has frequently been mentioned in literature. It has been given in various ways and in all reasonably sized doses, by mouth, subcutaneously, and intravenously. The pure acid as well as many of the salts have been used. Some writers mention its previous use in the treatment of the disease, while others, judging from their writings, thought that they were trying something new.

In a circular letter from the Headquarters of the Division of the Philippines, as late as January 11, 1902, we read as follows:

"The board ordered to inquire into and to investigate the disease of animals called surra have found Fowler's solution of arsenic, given intravenously, to destroy the parasite in nearly every case, and animals so treated are doing well, but such treatment is not as yet conclusive as to cure."

Lingard has given minute directions for the use of arsenic to accomplish the best results. Some writers assert that arsenic delays the course of the disease, and a few that cures may result, but the consensus of opinion is against this, and without doubt justly so. The statement that arsenic destroys the parasite in circulation is without a particle of evidence to support it. That the parasite may not be found by microscopical examination after such an injection is true, but the same results are just as likely to happen after the injection of any other substance; or, for that matter, it is occasionally difficult or even impossible to find the parasite for days at a time, when no treatment whatever has been given. However, it has been shown by others, and the observations have been confirmed by us, that the blood at this time is infectious when injected into susceptible animals, and that in such cases the parasites always reappear.

Laveran and Mesnil conclude that human serum and arsenic are the only substances that have shown any definite activity, and that under certain conditions arsenic may be used to prolong life.

They treated animals sick from nagana with arsenious acid, arsenite of soda, arrhenal, corrosive sublimate, Donovan's solution of arsenic and mercury, potassium iodide, quinine, a solution of arsenious acid, toluidin blue, methylene blue, and several of the newer silver salts, as silver lactate, fluoride, or trachiol, and carseinate of silver, or argonin, without curative results.

They quote Edington as having caused a disappearance of the parasites in sick animals by injecting one part of bile of animals dead of the disease mixed with two parts of glycerin, and state that he obtained immunity in healthy ones. Laveran and Mesnil used this treatment on dogs with negative results. In rats and mice it did not influence the course or duration of the disease.

Bruce used arsenite of sodium intravenously in large doses. He concluded that this treatment would cause a temporary disappearance of the parasites and somewhat prolong life, but that it would not cure the disease.

Lesur employed subcutaneous and intravenous injections of Fowler's solution, cacodylate of sodium, and arrhenal without definite results.

Deixome made use of arsenic, cacodylate of sodium, arrhenal and corrosive sublimate, but to no purpose.

Curry tried quinine subcutaneously and intravenously, methylene blue and salt solution intravenously, arsenic subcutaneously and by mouth, as well as various tonics, iron, cinchona, etc., but the animals died with the usual regularity in spite of treatment.

Schilling determined quinine, corrosive sublimate, and bile to be useless.

Voges used intravenous injections of large doses of quinine and methylene blue, with negative results. He employed also the following without any benefit: Enteral, sodium salicylate, turpentine, potassium permanganate, potassium iodide, and corrosive sublimate. He observed, as have so many others, a temporary improvement under the treatment of arsenic, life being prolonged, but no cures effected.

Three native ponies were treated with daily intravenous injections of large quantities of 1-1,000 solution of acetozone. A temporary drop of the temperature often followed treatment, and, as in the case of almost any kind of an injection, the parasites sometimes disappeared for a short time from the circulation, but definite or permanent results were not obtained, although the course of the disease was somewhat shortened.

As has already been shown, several substances have a destructive action for *Trypanosoma* in the hanging drop, but no such favorable action was obtained from any of them in treatment, whether by mouth, subcutaneously, or intravenously. The following have been used by us in the treatment of animals ill of the disease, but in none of them with hopeful results:

Tysol, creolin, infusion of pepo, granatum, santolin in the form of freshly prepared santonate of soda, strychnine arsenate, Fowler's solution, spigelia, copper arsenite, pelletterine, eucalyptus, quinine hydrochlorate and urea and combinations of several other salts and quinine, thymol, chloral hydrate, glycerine, methyl alcohol, acetic alcohol, barium chloride, calcium chloride, magnesium chloride, picric acid, oxalic acid, and various strengths of salt solutions alone and in combination with other drugs, carbolic acid, formaline, potassium permanganate, cyanide of potassium, urotropin, turpentine, cuprous sulphate, cupric sulphate, eosin water soluble, eosin alco-

hol soluble, potassium acetate, potassium chlorate, corrosive sublimate, arsenious acid, methylene blue, and several other aniline dyes.

The following serums have also been used: Antidiphtheritic, antistreptococcic, antirinderpestic, antiplague, antidysenteric, antitetanic, and all available prophylactic preparations.

Toxins, toxic cultures, and fresh cultures of numerous organisms have been used, including plague, dysentery, typhoid, paracolon, Malta fever, streptococcus cholera, and several strains of colon bacilli.

Blood parasites have been inoculated, including malaria and two varieties of filaria.

Extensive use has been made of human blood taken from fresh necropsies and in the following diseases: Cholera, dysentery, plague, malaria, typhoid, Bright's disease, leprosy, and malignant neoplasms.

Blood from the lower animals, both in health and in disease, has been employed; from healthy cows as well as from those suffering from rinderpest and foot-and-mouth disease; from sheep, goats, deer, rabbits, guinea pigs, frogs, chickens, ducks, pigeons, and several other species of animals.

Bile and other excretions and secretions, including urine, from both healthy and diseased animals as well as from those dead of surra, have been used.

Use has been made of the extracts from the lymphatics, the adrenal, and the thymus, as well as from organs affected with surra and other diseases.

Recourse has been had to X-ray and other light treatments, various emulsions and preparations of blood, and attempted attenuations of parasites.

As already mentioned under serum therapy, considerable time has been devoted to the preparation of specific sera; and numerous injections of aspirated serous fluids and the contents of collodion sacs have been kept in the abdominal cavity of susceptible animals for varying lengths of time.

In all this work we have not obtained a single recovery, nor have we been able to bring about conditions that would indicate the slightest hope of effecting a cure in animals when once they have contracted the disease.

In conclusion, we see no hope whatever for curative treatment along lines so far investigated, and the outlook for preventive treatment is hardly more encouraging.

From a casual observation, the conditions seem unfavorable, but if we go more deeply into the matter we find that they are not so bad after all. The disease is one which can certainly be prevented in a country not yet infected, and can as surely be eradicated from one where it is already epidemic by means which are thoroughly practicable. There is presented to us in the Philippine Islands to-day an opportunity to accomplish results which will be gratifying to the scientific world, and which should save the country from the annual loss of thousands of dollars.

SUMMARY AND CONCLUSIONS.

Trypanosomiasis is considered to be a general infection caused by *Trypanosoma*. The term *trypanosomiasis* in a general sense is used to designate all varieties of the infection as found in different animals. The long list of vernacular names now in use, except surra, should be discarded or else allowed to fall merely as synonyms, save in those cases where the infecting parasite is shown to be a species distinct from that of *Tr. evansi*.

A study of the history of the disease shows it to be of remote origin, records of it in some countries dating back for centuries.

It is distributed over large areas of the tropical and subtropical world, corresponding closely in its dissemination to the malarial zones.

Trypanosoma in general are discussed with reference to history; methods of study; general characteristics, including modes of multiplication, agglutination, and involution forms; distribution in the body and outside the body; life cycle.

The life cycle is as yet unknown, but is believed to be acted out entirely within the animal economy.

A tentative classification has been adopted for purposes of study, and each *Trypanosoma* of importance has been discussed with reference to its principal characteristics, habitat, and pathogenesis.

The differential diagnosis of *Trypanosoma* of mammals, like the life cycle, is left an open question, but the weight of evidence in literature and our own observations tend to the conclusion that at least three of the species to which separate names have been given are in reality identical with *Tr. evansi*.

Under the discussion of modes of transmission and infection the only point upon which emphasis need be placed is the conveyance of the disease through wounded surfaces, in which biting insects, particularly flies and fleas, serve as the principal agencies. It is clear that the prevalence of the disease is dependent upon the presence

of a host for the *Trypanosoma*, and of insects for their transmission. The animals which serve as hosts for the perpetuation of the disease through the dry season vary in different countries. In Manila sick horses exist in sufficient numbers to carry the infection from one rainy season to another; cows and rats may also aid in its perpetuation.

Statements concerning the infection of pastures and water and the transmission of the *Trypanosoma* through sound mucous membranes have nothing to support them.

After describing the general pathologic anatomy and symptomatology, we have taken up the discussion of the infection in various species of animals, paying particular attention to the disease in those of economic importance. The manner in which the symptoms vary in different animals has made this necessary, in order to enable us to make satisfactory diagnoses and intelligently to control the epidemic.

The course, the duration, the prognosis, the complications, and the diagnosis have all received a general consideration.

A chapter has been devoted to the consideration of the identity or individuality of surra, nagana, dourine, and mal de caderas. This is an important subject from a scientific standpoint, but as an aid to the evolution of means of prevention or cure it is of little consequence. As in the case of the parasite, we have with most other writers left the subject open, but we are strongly inclined to believe them the same disease, in which case surra would be the only vernacular name allowable. There is certainly nothing in the clinical study of these diseases to differentiate them. The only real arguments in favor of their individuality are based upon morphologic differences in the parasites, and, as has already been said, these appear to us to be so slight that a positive classification can not be founded on them.

The study of prophylaxis has included the consideration of quarantine laws intended to prevent the infection or reinfection of a country, as the case may be, and of methods for the control and eradication of the disease in territories where it already has a foothold. In discussing this matter we have limited ourselves almost entirely to the consideration of means adapted for destroying the hosts and supplemented by those suitable for combating the carrying agents. It has been thought necessary to go into this subject with considerable detail, and miscellaneous conditions have been given full consideration.

Prophylactic and curative serum therapy have thus far failed to give successful results, but if recent reports from Africa are to be trusted, preventive inoculation is not wholly without promise of success.

All methods tried for the treatment of the disease have been without results of practical importance or significance.

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[Compiled and edited by Miss Mary Polk, librarian, bureau of government laboratories.]

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A REPORT ON HEMORRHAGIC SEPTICEMIA IN ANIMALS IN THE PHILIPPINE ISLANDS, BY PAUL G. WOOLLEY, M. D., AND J. W. JOBLING, M. D.

The appearance of hemorrhagic septicemia in the Philippine Islands was a serious complication of the local cattle problem. Rinderpest, which had destroyed thousands of carabaos, and which had brought agriculture nearly to a standstill, was just beginning to be controlled by vigorous work with protective sera, and cattle were being immunized in China for importation into these islands. This work had been progressing very satisfactorily, when suddenly, and without warning, hemorrhagic septicemia appeared in a herd of cattle arriving in Manila from Shanghai. At about the same time that the disease was recognized here, reports were received from Hongkong giving accounts of a virulent disease prevalent there, which very much resembled bubonic plague in human beings, and which was called "cattle plague."^a

^aSince the above notes were written, the report of the Government bacteriologist at Hongkong has been received. In this there is a brief summary of the morphologic and cultural characteristics of the organisms found in the animals that died in the epidemic there. This germ grew readily on the "ordinary culture media." It was a bacillus that stained more deeply at the poles, and which did not stain by Gram's method, and which was nonmotile. Its appearance on culture media was similar to that of *B. coli*. All inoculated animals died after twenty-four to forty-eight hours, with symptoms of septicemia. From his facts Hunter concludes that he is dealing with a form of hemorrhagic septicemia. But whatever the disease may be, it is not presumably the same one that we are studying, judging from the description of the organism.

Thus far these reports have been so meager that we are unable to state whether or not the disease is endemic at that port, as it seems to be in other parts of the world, and whether or not it corresponds with the disease studied here.

That hemorrhagic septicemia existed in the Philippine Islands previous to the present epidemic can not be stated with any degree of definiteness. Since our preliminary report of the present outbreak, some native doctors have stated that they had previously seen animals dying in the same manner as the ones lately affected, but whether or not these cases were identical with ours can not be determined.

Carabaos are sometimes affected with a condition similar to heat stroke, and if one of these animals should die in such an attack, the clinical features presented by it might remarkably resemble those of the acute form of hemorrhagic septicemia. One of us had recently seen such a case, in which a carabao, lately landed from a vessel, had been driven through the town and was suffering for lack of water. It suddenly staggered and fell by the roadside, frothing slightly at the mouth, and was unable to rise for at least an hour, and not until it had been drenched frequently with water. If the animal had died in this attack, acute hemorrhagic septicemia might have been suspected and a correct diagnosis could have been made only after an autopsy. But the above-mentioned statements of the previous occurrence of hemorrhagic septicemia must be taken *cum grano salis*, for there is a proneness among many physicians and the laity here to recognize any symptom complex as the disease under discussion at the time. This tendency is well shown by the fact that pseudofarcy is taken for surra by men well acquainted with horses. It is, however, possible that hemorrhagic septicemia has been seen here before, and that the disease has thus far evaded detection by laboratory workers, even though these have a wide experience with cattle diseases.

The disease is a widespread one and has been noted in almost every quarter of the globe. The first cases were in Germany and were cited by Bollinger. Later reports of epidemics in Germany have come from Kitt, Hakoby, Buch, and others; from France, where Nocard and Leclainche have reported cases, as have also Galtier and others. Bosso, Oreste, and Armanni and others have detailed descriptions of epidemics in Italy. Poels reports cases from Holland; Jensen from Denmark; Piot from Egypt; Van Eecke, Fischer, and Hubenet from Java; Reischig, Sequens, and V. Batz from Hungary; Janson from Japan; Sanfellice, Loi, and Malato from Sardinia; Pease from British India; Carrougeau and Blin and Carré from Indo-China; Lignières from South America; and Smith, Wilson and Brimhall, Reynolds, Fennimore, and Nocard from the United States. It is easy to see how the spread may have included the Philippine Islands, if the disease is a contagious one and not endemic in that Archipelago. There is a possibility that China is not to blame for the cases recently discovered here; it may be that the disease is endemic in the Philippine Islands, and that by food or water the organisms gained access to these animals through wounds of the gastro-intestinal tract (or even without such wounds) or through wounds on the surface of the body, or possibly by way of the respiratory tract.

It is now settled beyond doubt that organisms resembling those of hemorrhagic septicemia are found in waters and soils. It has also been shown that similar ones are present on the mucous membranes of healthy animals. Moore, of the Bureau of Animal Industry, at Washington, for instance, has demonstrated that organisms resembling those of hemorrhagic septicemia and capable of producing the disease occurred in 90 per cent of the cattle, 48 per cent of the hogs, 50 per cent of the sheep, 16 per cent of the horses, 30 per cent of the dogs, and 90 per cent of the cats examined by him. Davaine, Pasteur, Gaffky, Gamaleia, S. Mayr, and Kitt have found organisms in waters, soils, sputum, and bronchial secretions, which, injected into the circulation of animals, caused septicemia which agreed with the usual disease in all its details.

Since this disease so closely resembles bubonic plague it might be supposed that it corresponds with it also in the sources and means of infection, but these points are awaiting explanation. Since the organisms occur so commonly in healthy animals it is probable that a lowering of resistance to disease, whether brought about by trauma or by abnormal conditions of environment, relatively increases the virulence of the organisms and brings about conditions from which infection and disease result. This is certainly true in the sporadic pneumonias of cattle, described by Theobald Smith, who believes that the organisms present in such conditions are secondary invaders.

The history of the present epidemic of hemorrhagic septicemia in the Philippine Islands is as follows:

A shipment of cattle arrived in Manila Bay from Shanghai on May 28, 1903, and was kept on board until June 1, when the animals were sent to the Perez estate in Paco. On the following day two of the animals were noticeably ill and were sent to the serum laboratory for observation.

Case I.—The first animal to die was very weak when first observed, but in fair physical condition otherwise. The conjunctivæ were somewhat congested, respiration was rapid and the feces normal. Temperature, 30.2° C. When taken off the truck at the laboratory it staggered a few steps and fell on its side. There were numerous bruises on the body, probably the result of a rough voyage across the China Sea. It ate food when placed near it, and also drank, although it did not, apparently, suffer from thirst. It had no cough. During the next few days it became a little brighter and somewhat stronger. On June 6 it was again weak and could not stand up, the hind legs seeming to be especially feeble. It gradually became weaker and diarrhea developed, but with no traces of blood or mucus. Death occurred on the ninth day after landing.

The post-mortem examination showed a few patches of subcutaneous edema on the sides. There were a few small pericardial hemorrhages about the base of the heart. The lungs showed a number of subpleural nodules, which on section exposed granular areas, similar to those seen in broncho-pneumonia, in the stages of red and gray hepatization and suppuration. The suppurating areas were filled with a thick, granular, greenish yellow, sticky material.

Cultures were made from the lung abscesses in agar and blood serum. After twenty-four hours at 37° C., the agar tubes showed a growth of small, transparent, greyish, round colonies. The blood serum showed a very scanty growth of small colonies. Transfers were made from these tubes to various other media, and plates were also made. After a careful study of its morphologic and cultural characteristics, it appeared that the organism under consideration was a short bacillus with rounded ends, and nonmotile. Its measurements varied between 1 and 2 microns in length and 0.3 and 0.5 microns in thickness. The largest forms were seen in glucose media, the smallest on potato. From the animal body it showed well-marked polar staining, although this was not so distinct in organisms grown on artificial media. It was stained easily with the usual watery aniline stains, but was not stained by Gram's or Weigert's methods. The rods, as a rule, occurred singly, often in pairs, occasionally in chains of five or six individuals. The appearance of the growths on the usual culture media was in no way characteristic. The colonies on agar were small, greyish, transparent, and well circumscribed with little or no tendency to spread. On all the solid media approximately the same appearance was noticed. In gelatin no liquefaction was caused. In bouillon a granular deposit was formed on the sides and bottom of the tube. During the first few hours of growth, the whole medium was faintly clouded, but as the sediment was deposited the liquid became clear. After a few days the sediment became viscid, as could be shown by shaking the tube, when the precipitate rose, not in flocules but in threads. In Dunham's peptone solution the same general characteristics were observed as in broth, but the growth was not so abundant. Indol (cholera red) was produced rapidly, so that at the end of twenty-four to thirty-six hours the addition of pure sulphuric acid (free from nitrites) produced a well-marked pink color. No phenol could be appreciated. No gas was produced in solid media containing sugars, nor was the reaction changed. Milk remained unaffected even after ten days; no acid was produced, no coagulation was caused, and there was no reduction of litmus. Stab cultures in solid media showed nothing remarkable. The growth followed the line of inoculation closely with no tendency to spread, and extended to the bottom of the tube as a finely granular growth composed of small colonies. The surface growth was small, just surrounding the point of entrance of the needle.

Case II.—The second carabao was also taken to the serum laboratory on a truck, and on arriving there was unable to walk more than 30 feet. Its eyes were clear, the respiration quickened, and the body covered with numerous bruises. On the 4th of June it was able to walk and graze, and seemed to be in good condition. On June 14 it was again dull and weak, but still able to walk; the greatest weakness being in the hind quarters. Nevertheless, in spite of a good appetite, and in the absence of other symptoms, the animal gradually became greatly emaciated. On June 21 a swelling was noticed on the inner and outer sides of the left ankle. At this time the animal was hardly able to stand, although the appetite was still fair. The swelling on the ankle was incised by Doctor Slee and the contents evacuated. The abscess cavity was a loculated one and the incised tissue was quite cedematous. On June 25 diarrhea developed and two days later, when just about to die, the animal was killed and an autopsy done immediately.

The findings were as follows: Besides the incision over the left ankle, there were dried scars on both sides of the body and a small opening, discharging a greenish yellow pus, in the left flank near the quarter. Dissection of the left ankle showed that the abscess cavity extended around the joint without involving it, but reaching far up the leg. An opening into the abscess on the flank led into a mass of suppurating glands, which looked much like the broken-down ones of bubonic plague, save

that the contents were more granular. The tissues about these suppurating areas were infiltrated with a gelatinous exudate of distinct yellow color. In the intermuscular and surrounding tissues there were more or less well-marked hemorrhages. On skinning the animal, a widespread subcutaneous gelatinous œdema was discovered with large and small hemorrhages. In the stomach walls and beneath the pericardium and the pleura, hemorrhages were present, some of which were well circumscribed and others irregular in outline. There was a very large extravasation of blood into the mediastinal portion of the parietal pleura, and another similar one along the descending aorta.

The lymph glands were generally enlarged, pale, and œdematous, but some were smaller and hemorrhagic. There were petechias in some of the œdematous glands. The lungs were, for the most part, crepitant, although there were areas in the left one which resembled the stage of red hepatization of broncho-pneumonia. The spleen was of about normal size, with no hemorrhages into its substance, but with many subcapsular ones. The liver showed nothing remarkable. The kidneys were of fair size and the perirenal tissues were œdematous, and their pelves were filled with a gelatinous material. There were no hemorrhages into mesentery.

In the abscesses from the left ankle and from the hind quarters small polar-staining bacilli were found in almost pure culture. Smears from the lymph glands showed similar organisms, but the heart's blood was apparently free from them. Cultures showed an organism that corresponded with that from Case I.

Case III.—This animal, a full-grown carabao, was apparently perfectly well until one morning, when it looked stupid; its gait was clumsier than usual and its eyes appeared to be sunken. It did not care to use the mud bath, but wandered about aimlessly (the native overseer said that it was insane). On the third day weakness across the loins and in the forelegs was evident. Its appetite was still fair. On the morning of the fourth day it fell over and was unable to rise again, and died in the afternoon. Smears showed a few organisms that were polar-staining. Culture on placenta fluid showed organisms that resembled diplococci. Culture lost in moving.

Case IV.—This animal was stupid and weak when first noticed, and as nearly as could be determined had been sick for about three hours. It kept on its feet and moved from place to place for several hours, eating occasionally. Death took place suddenly. Smears from organs showed a few polar-staining organisms. Cultures not made.

Case V.—This carabao lived about three days after the appearance of the first symptoms, the principal one of which was weakness, especially in the fore legs. At autopsy the base of the heart was œdematous, and there were scattered areas of subcutaneous œdema with a few hemorrhages.

Case VI.—Death was very sudden, occurring twenty-four hours after the beginning of the illness. Autopsy revealed œdema and blood-stained infiltrations about the inguinal and prescapular glands. The latter were much swollen and showed areas of necrosis and a few small hemorrhages in their substance. Hemorrhages varying in size were present in the inner and outer surfaces of the intestines, under the visceral and parietal pleura, under the parietal and visceral pericardium, and under the endocardium. Petechiæ were present on the surface of the liver and were especially well marked on the inner surfaces of the branches of the portal vein. A few small hemorrhages were found under the capsule of the spleen and under the surface of the diaphragm. Smears from lymph glands, liver, spleen, and lungs showed polar-staining bacilli.

Case VII.—The duration of the illness was two and one-half days, during which the animal could scarcely stand, although the appetite remained good. The almost characteristic œdemas were well marked in this case, and polar-staining bacilli were found in smears.

Case VIII.—This animal, one of the finest in the herd, was alive and well on the morning of June 7. The following morning it was found dead. The post-mortem examination showed hemorrhagic œdema under the skin along the spine, about the prescapular glands, and around the base of the heart. There were ecchymoses on the surface of the heart, under the capsule of the spleen, in the inguinal and prescapular glands, in the pancreas, in the gall bladder, and under the serous and mucous surfaces of the intestines.

Smears from heart and spleen showed polar-staining bacilli, some of which showed evidences of having been a capsule or pseudo-capsule. Blood serum from the case had no agglutinative reaction on the bacilli previously obtained from other cases.

Cases IX and X were calves. Their clinical histories and the details of the autopsies are wanting. All that is known is that in neither case was the spleen enlarged; that there were subcutaneous gelatinous œdema, and the usual œdema about the base of the heart in each.

Case XI.—This animal died within twenty-four hours after the appearance of the first symptoms. It was large and well nourished, and when examined was lying on the ground, the legs stiff and the head drawn back. The agonal stool was bloody. There were hemorrhages along the spine into the subcutaneous tissues, as well as on the surfaces (inner and outer) of the small intestines. The prescapular glands showed areas of hemorrhage and necrosis.

Case XIII.—This was a fairly well-nourished carabao, which had arrived from Shanghai three days previous to the appearance of illness. It was well on the evening of July 22. On the following morning it was found dead. In this case the lesions were confined to the heart and lungs. The subcutaneous gelatinous edema seen in the other cases was absent. The lungs were not collapsed and contained air in only a few patches. The costal pleura, which was intensely inflamed and showed numerous ecchymoses, was covered with a thick stratum of fibrino-purulent exudate. The visceral pleura was in a similar condition. The mediastinum was filled with a mass of yellow gelatinous material composed of serum and fibrin. On section the lung tissue was red, in places very dark, and divided into large and small lobules by white fibrins and fibrinous bands intersecting in all directions. These bands varied from one-eighth to one-half an inch in width, and were studded with loculi containing a sero-fibrinous and fibrino-purulent material. In the pericardial cavity was a large amount of serous fluid containing floccules. Both layers of the pericardium were covered with fibrinous shreds. The serous membrane under this exudate was inflamed and dotted with ecchymoses. The auricular appendages were thickly mottled with hemorrhages.

Smears from the heart's blood, lungs, liver, and lymph glands showed a considerable number of polar-staining bacilli, and cultures showed a similar organism in uncontaminated growths.

This case followed closely the description of sporadic pneumonia as given by Theobald Smith.

Besides the cases of hemorrhagic septicæmia seen in carabaos, a native horse was found to be suffering from a malady which was caused by the same organism. In this case the chief lesions were found in the lungs, and these corresponded perfectly with those of Case I. There was also a well-marked gelatinous edema about the base of the heart. The organism was recognized in smears and cultures, and identified with that from Case I.

In summarizing the chief clinical features of these cases we can say that there have been three fairly well differentiated types; one, intensely acute, in which the animals died within a few hours after the onset of symptoms; one less acute, in which the animal suffered chiefly from weakness in the limbs, and more especially in the hind quarters (during the course of this form of the disease the appetite was little or not at all affected); lastly, one in which the course was prolonged, accompanied by great weakness and emaciation and occasionally by suppuration. These are not distinctly defined types, for rarely does the disease affect the animals in the same way, except in the acute form, in which the course is so rapid that there is little time to observe symptoms.

The pathological types are as indefinitely defined as the clinical types. In a general way, however, there is a pulmonary type, in which the lesions resemble those of broncho-pneumonia, sometimes with abscess formation, and with or without pleuritis. Combined with these changes there may be marked changes in the interlobular tissues, with the formation of fibrous bands and with emphysema. Another type is the rapidly fatal septicæmia form, in which there are few macroscopic changes in the organs beyond incipient parenchymatous degenerations. The third type is a glandular and suppurative one which terminates in a general infection. In all these forms there have been more or less widespread hemorrhagic lesions, combined with gelatinous edemas. This last-named condition was especially frequent about the base of the heart, and in some cases it was the only macroscopic lesion.

In but few cases have complete temperature charts been kept, because most of the animals have come from herds regarded as healthy, and have died too suddenly to allow records to be prepared. The temperature charts of Cases I and II will, however, be appended. These curves show very little except a primary rise of temperature, after which there is a fall, with the subsequent curve running either near the base line or very irregularly.

The clinical cases given above agree in many points with those described in the literature, but in many details, too, they do not. Wide variation clinically and pathologically seems to be one of the most common features of the disease caused by *B. 1. Purisepcticus*.

In Bollinger's report the cases are divided into an exanthematous and pectoral type. The former is characterized by fever, swellings of the face and neck, inflam-

mation of the mouth and tongue, with ecchymosis under the mucous membranes, and bloody diarrhea. Such we have not seen, nor have we observed any cases resembling them. This may be because the hide of the animals that we meet with here is thick enough to prevent the oedematous swellings from becoming apparent, for certainly in the majority of cases there have been subcutaneous oedemas, some of quite considerable size. The latter type showed, principally, pulmonic lesions. We have studied three cases that followed this type, two in carabaos and one in a horse. In one carabao and in the horse the chief lesion was a broncho-pneumonia without pleuritis; in the other carabao it was a pleuro-pneumonia.

Lignières divides the cases he has seen into three classes: First, a diarrhetic one—the acute form—in which death occurs in from one to two days after the onset of the diarrhea. In this, pectoral lesions are common (i. e., pneumonia, pleurisy, etc.). The second class he calls, “entéque.” The course of this form is more chronic, and the animal may live for three to four weeks with more or less fever and fetid diarrhea, culminating in anæmia and death. The third or cachetic form is marked by wasting, articular localizations, and profound anæmia, followed by death.

Speaking generally, the commonest types in the literature are the exanthematous and pulmonary. Oreste and Armanni described cases in which oedemas and hemorrhages were the chief lesions. Many of Kitt's animals showed pneumonia and pleuritis, Jansen's showed phlegmonous oedemas, fibrinous pleuritis and pericarditis, and gastro-enteritis; Galtier described hepatization of the lungs, subendocardial hemorrhages, and peritonitis; Guillebeau and Hess found fibrinous pleuritis and pericarditis, hemorrhagic infarction in the lungs, and small hemorrhages in the serous membranes and in the mucous lining of the intestine; Pease observed cases in which the chief lesions were ecchymosis, widely disseminated in the bodies; Fennimore remarked inflammation of the mucous membranes of stomach and intestines, pleuritis, pericarditis, and oedema of the lungs; and Smith carefully studied and minutely described peculiar lung lesions in which interlobular changes were an important feature.

From a summary of the facts given in the literature we may conclude that the animals attacked are of all ages, the onset is usually sudden, the course is rapid, and death occurs in 85 to 98 per cent of the cases. In the less rapid forms of the disease the symptoms may be refusal of food, cessation of rumination and lactation. The initial rise of temperature may be followed by a drop to normal or subnormal. The respirations may be rapid or labored; bloody material may be discharged from the nostrils, bowels, or bladder, and noncrepitant swellings may occur on face, neck, or about the back and ankles.

From all these varying types of disease similar organisms have been isolated. In the outbreak which we have studied, the characters of the microbe have been as follows: Short bacilli with rounded ends, polar staining, occasionally encapsulated and nonmotile; nonliquefying, non-Gram staining, growing invisibly on potato, not producing gas, not coagulating milk or reducing litmus, producing indol and nitrites and not forming spores. It is an organism which corresponds closely with the bacilli of hemorrhagic septicæmia of Hueppe, and especially with that member of the group called *B. borisepticus* (Kruse), *B. borisepticum* (Kruse-Migula), *B. plurisepticus* (Kitt), *B. bipolare multocidum* (Kitt), *B. der buffelseuche* (Oreste-Armanni), etc. The chief differences between the present bacillus and the ones described in the literature are its indol production, which is invariable, and its invisible growth on potato, which also appears constant.

Animal experiments. ^a—The organism has been injected into guinea pigs, rabbits, monkeys, small birds, a dog, a chicken, and a calf. In all but the last three animals death has followed in from nine to thirty-six hours following subcutaneous inoculation, in from nine to twenty-four hours after intrapleural injection, in five to eighteen hours after intraperitoneal inoculation, and in five to fourteen hours after intravenous injection of virulent material. Subcutaneous injection of the filtrate collected after filtering bouillon cultures through a Pasteur-Chamberland filter caused no symptoms. Subcutaneous injection with a culture kept at 60° C. for ten minutes killed a rabbit in thirty-six hours. Intravenous injection with the same material killed in eighteen hours. In both these two last cases the organism was recovered from the heart's blood.

The lesions, in animals killed with virulent cultures, varied with the length of the disease and with the animal used. In all there was oedema and some hemorrhagic infiltration or ecchymosis at the site of inoculation. In addition to this two or three cases were noticed in which there were large collections of pus surrounded by tissues

^aIn these experiments, Mr. Clegg, assistant bacteriologist in the biological laboratory, has given us much valuable assistance.

in a state of coagulation and necrosis in the immediate neighborhood of the wound of inoculation. The more resistant the animal and the more attenuated the organism (within certain limits) the greater was the tendency to suppuration.

The protocols of the animal cases are as follows:

Rabbit 321. Inoculated subcutaneously with 0.3 c. c. of an emulsion of a 24-hour old agar growth. (Organism from Case I.) Dead in eighteen hours. Large hemorrhage at site of inoculation, and a few small ones in axillary and inguinal glands. Lungs congested, vessels of the heart distended with blood. Liver soft and showed diffused pale areas of fatty or necrotic tissue. Adrenals congested. No changes in gastro-intestinal tract. Small amount of fluid in peritoneal cavity. Smears from the liver, spleen, heart's blood, and site of inoculation showed the typical organisms which were recovered in pure culture from the blood.

Rabbit 322. Inoculated subcutaneously with 1 c. c. of a suspension of a 24-hour old agar growth of the organism obtained from Case XIII. Dead in five hours. No well-marked lesions. Some edema about the wound of entrance. Liver and kidneys congested. No hemorrhages or necroses. Smears from heart's blood, spleen, kidney, and liver showed the typical organisms, and these were obtained in pure culture from the blood.

Rabbit 335. Inoculated intravenously with 1 c. c. of a bouillon culture of the organisms from Case I, which had been kept at 58° C. for ten minutes. Dead twenty-four hours later. Autopsy showed focal necroses in the lower lobes of both lungs, in liver, and spleen. Smears from spleen, kidney, and blood showed a few small polar-stained bacilli, which, however, were recovered in pure culture.

Monkey 256. On June 16, 1 c. c. of a bouillon culture was injected under the skin of the right side. On June 18, 1 c. c. of a culture in placenta fluid was injected into the peritoneal cavity. Death occurred six hours after the second inoculation. About the points of inoculation were areas of edema. Surrounding the point of inoculation on the right side was also a large intermuscular abscess filled with a pale, greenish-yellow, gelatinous pus. Practically the whole side of the animal was the seat of a subcutaneous gelatinous edema. The peritoneal cavity contained a large amount of sanguinous fluid, and the liver of the peritoneum was dulled, and it was injected. The other lesions were cloudy swelling of the parenchymatous organs. Smears from the spleen, liver, and peritoneum, and from the pus at site of inoculation showed polar-stained organisms. None seen in blood. In several leucocytes from the peritoneal cavity, polar-stained bacilli were seen. The heart, peritoneum, and liver showed pure cultures of this organism.

Monkey 297. Inoculated intra-peritoneally with 1 c. c. of a broth culture of the organism from the horse mentioned above. Death in thirty-six hours. The abdominal wall about the wound made by the needle was cedematous. The scrotum was distended and cedematous. There were well-marked subcutaneous ecchymoses and gelatinous edema with a certain amount of purulent infiltration. Coils of intestines were adherent and there was a quantity of sanguino-purulent exudate in the peritoneal cavity. The pus extended down along the spermatic cords into the scrotum. The left testicle was much enlarged and contained some purulent and ecchymotic areas. The right testicle was small and surrounded by a purulent exudate. The intestines showed a few small hemorrhages under the serous layer. The other organs showed no marked change. Smears from the abdominal cavity, liver, spleen, subcutaneous abscess, and testicular abscesses, showed polar-stained bacilli. These were recovered in pure culture.

These case reports of animals dying spontaneously and those dying after inoculation will give some idea of the ability of the organisms to cause widely varying types of disease. It is as Reynolds has said: "For the present at least we must consider the term hemorrhagic septicaemia as quite inclusive, a sort of generic name which must cover a multitude of varying types of disease."

When we encountered the first cases of the present epidemic we feared that the outbreak might take on as dangerous proportions as it had in some of the epizootics first reported. And as time has gone on this fear has been partially realized, but we shall hold to the idea that the cases have been the direct result of trauma in many of them, and the indirect of infection with an organism present in the mouths of healthy animals.

It does seem very probable now that a pasture may become infected, and that new animals placed on such infected ground may die of the disease in one of its forms, especially if the animal is in any way predisposed to disease. For this reason it seems most unwise, in the present state of our knowledge of the disease, to move animals from place to place and so risk infecting new ground to be used by well animals.

In one of the corrals in Manila a few animals in one herd had died. Following these deaths came heavy rains so that the corral resulted in a great mudhole. Into

this place a new herd of carabaos was driven after they had crossed the China Sea from Shanghai. Following the advent of these animals deaths occurred rapidly, and in all but a few of the dead the lesions of hemorrhagic septicæmia were found.

It is our own opinion that the disease was the result of the rough sea voyage, change of diet, the preliminary inoculation against rinderpest, and finally the filthy surroundings in Manila. Under these circumstances disease might be expected.

The question concerning the source of the infection by which death resulted remains to be answered. Were the organisms in the animals themselves? Were they in the mud of the corral? Neither of these questions can be answered positively as yet. We have not been able to find the bacilli in the mud. But just so long as there is any doubt the animals must be treated as though they could scatter the germs of the disease with their excreta.

Up to the present time there has been no evidence that the disease is directly contagious, although Carrougeau and Blin, Bollinger, Friedberger and Frohner, and others considered the disease, which they studied, was. On the other hand, Nocard and Leclainche think that the cases are sporadic and that the disease is enzootic, and Wilson and Brimhall and Reynolds believe that it is not contagious.

For the purpose of eliminating all or most chances of contagion, we suggest that each animal in a suspected herd should be isolated or staked out separate from the rest of the herd for at least ten days after the occurrence of the last case in the herd to which it belongs, and until any abrasions on the surface of the body have healed. (Brimhall and Wilson have suggested that skin lesions may play a part in the spread of the disease.) While the herd is under suspicion none of the animals should be allowed to use the mud baths. After an animal has died the ground upon which it has stood should be cleansed by fire or antiseptics, and if it has had access to the mud bath this should be disinfected in the most thorough way with lime or crude carbolic acid and then flushed out with water. There seems to be some difference of opinion as to whether the organism is able to live any length of time in contaminated water, but since similar ones have been found in rivers and in soils it is wiser to be on the safe side and use all precautions. Theobald Smith states that the organism is very vulnerable, and Nocard and Leclainche say that it is a facultative parasite. The result is that for the present it must be dealt with as though its resistance were great. Kitt, in Kolle and Wassermann's *Handbuch*, recommends that it be treated as though it were the bacillus of anthrax.

Up to the present time we have been unsuccessful in obtaining any serum or protective substance which will modify or ameliorate the course of the disease in experimental animals. Work along these lines is, however, being done and will be made the subject of a later report. Wilson and Brimhall report that they were able to produce a fairly high degree of immunity. In a book on "*Les Maladies Microbiennes des Animaux*," by Nocard and Leclainche, it is stated that the belief of Lignières that the organism of bovine pasteurosis can be attenuated and used as a vaccine is possible, but the details of his method are not given, and thus far we have been unable to obtain them.

NOTE.—We have been interested to hear, since the notes for this report have been prepared, that there have been epidemics of an unknown nature among chickens and swine in the provinces about Manila. The reports make it seem probable that these diseases are related to the hemorrhagic septicæmia of fowls and hogs.^a We have received from a gentleman in Manila a chicken that had died suddenly. From this we have isolated an organism that resembles the bacillus of chicken cholera, which, when inoculated into small birds in minimal quantities gives rise to a rapidly fatal septicæmia that corresponds exactly with chicken cholera. In inoculating with this organism a needle whose tip was covered with a culture of the organism was plunged through the skin and into the subjacent muscles. The disease prevalent among swine remains to be determined.

These observations make it seem probable that chicken cholera is endemic here, and, if there is any value in the analogy, that other forms of hemorrhagic septicæmia may be.

^a Hog cholera and swine plague are already known to exist in these islands. See Annual Report of Superintendent Government Laboratories and Report of Commissioner of Public Health, 1902.

LITERATURE TO ACCOMPANY A REPORT ON HEMORRHAGIC SEPTICÆMIA OF ANIMALS IN THE PHILIPPINE ISLANDS, BY PAUL G. WOOLEY, M. D., AND JAS. W. JOBLING, M. D.

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Following is the report of the bacteriological examination made in this laboratory. A complete report, including the clinical histories of the cases, will shortly be published as a bulletin from this Department.

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Throughout the acute stage of the infection this bacillus was present in considerable numbers and apparently in pure culture. When the acute symptoms had subsided it could be found only with difficulty and finally disappeared. After gangrene appeared in Miss B.'s finger nothing but the staphylococcus pyogenes albus could be isolated.

Finally, pieces of tissue removed in an aseptic manner from Miss B.'s finger were forced into the substance of a slant of aseptic fluid agar and incubated at body temperature. No growth appeared during the first three days' incubation, but on the fourth day one of the pieces of tissue was surrounded by a halo of cloudiness, which gradually increased in density and finally assumed a yellowish color, especially near the surface of the slant. Transplants upon aseptic fluid agar showed no growth in twenty-four hours, but in forty-eight hours a delicate typhoid-like, whitish growth could be seen along the line of inoculation. This gradually assumed a lemon-yellow color. Stained preparations from this growth showed small, slender rods resembling those seen in the preparations made directly from the purulent exudate. When suspended in a hanging drop of bouillon these rods were very actively motile. They lost the color when Gram's method was applied.

"The "ordinary" media used were prepared according to the directions of the American committee (Reports and Papers of the American Public Health Association 1898, XXIII, p.60) with a reaction of 1 per cent acid to phenolphthalein. The ascitic fluid agar was kindly furnished by Mr. Lindquist of the First Reserve Hospital Laboratory. It was prepared by mixing equal parts of fluid glucose agar and acetic serum and then sterilized by the intermittent method. For better methods of preparing human serum media, see Eyre, Jour. of Path. 1900, V, 6, and Libman, N. Y. Med. Rec., 1903, LXIII, 237.

Notwithstanding the difficulty experienced in obtaining the first culture, the bacillus adapted itself to a saprophytic existence and grew readily upon the "ordinary" media. In no instance could growth be detected with the naked eye after twenty-four hours' incubation, but it was evident in forty-eight hours. (This peculiarity persisted in 10 or 12 transplants during two months' cultivation, but after about three months of saprophytic existence the growth, though faint, is visible in twenty-four hours.)

Cultural characteristics.—On a slant of nutrient agar the growth is visible in forty-eight hours as a distinctly yellowish streak confluent below, with small, circular, isolated colonies above, and much more luxuriant than that upon ascitic fluid agar. In a stained preparation the bacilli appear thicker than when taken from ascitic fluid agar and show a considerable change in their morphology—most of them being spherical or coccoid, others ovoid and in pairs. A few appear as distinct rods. They are nonmotile when suspended in a drop of bouillon. When an isolated colony from such an agar slant or from an agar plate is transplanted upon ascitic fluid agar, the growth reverts in its appearance to the more delicate type, while the organisms all assume the thin bacillary form—actively motile when suspended in a drop of bouillon.

When plated in agar, pin-point sized colonies are visible in forty-eight hours, and in four or five days reach a diameter of $\frac{1}{2}$ mm. In forty-eight hours, the superficial colonies appear, under a low-power lens, as uniformly granular disks with translucent edges. In four days coarser granulations may be seen about the central portion of the disks, and the colonies assume a chrome-yellow color. These colonies, situated between the agar and the Petri dish, spread out like the superficial colonies and have the same appearance microscopically, but are unpigmented.

In bouillon a faint, uniform cloudiness appears in forty-eight hours. In the hanging drop short nonmotile rods may be seen. In a week the fluid is densely clouded, a precipitate collects at the bottom of the tube, while a yellowish white pellicle is formed on the surface. This pellicle, if unbroken, becomes thick and wrinkled in the course of ten or twelve days. No indol is produced.

In Dunham's peptone solution a faint turbidity appears in four days. No pellicle is formed and the growth is gradually precipitated. No indol is produced.

In nutrient gelatin (20 per cent, liquified by the warm weather) growth appears as small isolated colonies floating on the surface and scattered throughout the medium. No peptonization occurs during five days' growth, at about 28° to 30° C., for the gelatin solidifies readily when placed upon ice.

In litmus milk no visible change is produced during the first four days. In a week there is slight reduction of the litmus at the bottom of the tube. In twelve days the litmus is completely reduced excepting at the surface, where it is still blue for a depth of 2 or 3 mm. No coagulation occurs.

In stab cultures, in glucose agar, and litmus lactose agar no particular changes are produced. A granular growth appears along the upper portions of the stab, while on the surface a smooth, circular, elevated growth appears. This gradually changes in color from a lemon to a chrome yellow.

In glucose bouillon, in the fermentation tube, no gas is produced, and the closed arm remains clear during twelve days' observation.

On a slant of potato the first growth appears in four days as minute lemon-yellow colonies. In eight days the colonies are confluent, of a chrome-yellow color, and present a wrinkled surface. In ten days the surface is elevated into snake-like folds. When stained from an eight-day potato culture the bacilli appear as irregularly clubbed rods. Nothing resembling spores can be stained.

Inoculation experiments.—(1) Monkey No. 260 received a subcutaneous injection in the chest of 1½ c. c. of a physiological salt solution emulsion of the purulent secretion from Miss B.'s finger. No result followed. A few days later a small piece of tissue curetted from Miss B.'s finger was placed under the skin of the chest and the wound covered with flexible collodion. Four days later a small amount of purulent secretion appeared through cracks in the collodion dressing. This contained pus cells and a few small bacilli, which could not be grown upon plain agar. In a few days the wound had healed completely.

(2) Monkey No. 261 received a subcutaneous injection in the chest of 1½ c. c. of a well-clouded emulsion of the purulent secretion from Doctor W.'s finger. Microscopical examination of the pus showed that numerous bacilli were present. In forty-eight hours a pea-sized nodule appeared at the site of injection. Two days later this had completely disappeared, and the monkey remained well during a month's observation. Then it received in the tip of the right forefinger an injection of ½ c. c. of a twenty-four hour bouillon culture of the bacillus isolated from Miss B.'s finger. Microscopically the culture showed numerous coccoid bodies and short rods. No particular change was noticed during the first two weeks' observation, but in the

course of a month the monkey's hand showed an inflammatory process, affecting the first three fingers. The tip of the forefinger was gangrenous, and the middle and ring fingers showed swollen, globular, whitish tips. Coverslip preparations showed cocci and bacilli. Many of the latter were very minute rods, losing the stain when Gram's method was applied. They could not be isolated upon ordinary agar plates, and plates made with human serum, according to the method of Pakes,^a were rapidly overgrown by other organisms. The staphylococcus aureus and albus and some unidentified, large, rapidly-growing bacilli were present in considerable numbers. The animal was chloroformed, and at the autopsy nothing in particular was noticed, excepting swelling and congestion of the right axillary glands. Sections from the spleen, liver, and kidney appeared normal. Those from the right forefinger showed that the inflammatory process was apparently limited to the outer layers of the skin, the malpighian layer being almost wholly replaced by a mass of nuclear fragments and many cocci and bacilli. The interapillary pegs of the epidermis showed marked canthosis—long, slender processes of epithelium running deep into the subcutaneous tissue. The subcutis showed almost no infiltration.

(3) A young rabbit, No. 269, received in the subcutaneous tissue of the left ear an injection of about $\frac{1}{2}$ c. c. of a densely clouded seven-day old bouillon culture of the bacillus isolated from Miss B.'s finger. This was followed by hyperæmia at the site of the injection, but no inflammatory process resulted.

(4) A young rabbit, No. 272, received an intravenous injection of $\frac{1}{2}$ c. c. of an emulsion of the same bacillus taken from a seven-day old culture on ascitic fluid agar. It remained well during two weeks observation, when it escaped.

(5) Guinea pig No. 270 received an intraperitoneal injection of 1 c. c. of a seven-day old bouillon culture of the same bacillus. It remained well during a month's observation.

Results of the agglutination test.—Blood for these tests was obtained from Doctor W.'s ear and from Miss B.'s infected finger at the time when the infectious process was in a retrogressive stage. Both specimens failed to agglutinate the bacillus in two hours at a dilution of 1:10.

There were several cases of acute contagious conjunctivitis in the hospital at the time when Doctor W.'s finger was infected. The bacilli in the coverslip preparations from the cases correspond in their morphology, size, and staining reactions with those in the preparations from Doctor W.'s and Miss B.'s fingers. They also correspond in their morphology, distribution, and staining reactions with the descriptions of the Koch-Weeks bacillus. They could not be cultivated upon the ordinary media nor upon agar smeared with human blood. As we believe the organism described above to be the Koch-Weeks bacillus itself, or a closely related "type" of this organism, it seems desirable to append a description of this bacillus and of other organisms described as resembling it.

Acute contagious conjunctivitis (otherwise known as acute or epidemic catarrhal conjunctivitis, muco-purulent conjunctivitis, or vulgarly as "pink-eye") is a highly contagious, muco-purulent inflammation of the conjunctiva, accompanied by some swelling of the lids (Weeks). The disease is self-limited, passing through an acute stage and then gradually subsiding. Recovery usually occurs in from two to three weeks. The disease is said to be especially prevalent in Egypt, but it occurs throughout the globe.

The specific cause of the disease, a small bacillus, was first seen in a case of conjunctival catarrh by Koch (1) in Egypt (1883) and cultivated, and proved to be the specific micro-organism by Weeks (2) in America (1886). Therefore the virus is usually known as the Koch-Weeks bacillus. Their work has since been confirmed by Kartulis (3) in Egypt, Morax in France, and Wildbrand, Sängner, and Stalin (4) in Germany.

The Koch-Weeks bacillus is described^b as a minute, nonmotile rod (0.25 by 1μ), resembling the influenza bacillus or that of mouse septicæmia. In acute cases the bacilli occur in large numbers in the muco-purulent secretion, often being taken up in considerable numbers by the phagocytes. In subacute cases they may be scarce, and in the later stages of the disease they disappear entirely. They often lie in pairs, end to end, or sometimes in short chains within and outside of the pus cells of the secretion. They stain well with the ordinary dyes, but do not retain the stain when Gram's method is applied.

When transferred from the human body to artificial media, this organism is even more restricted in its conditions of growth than the influenza bacillus, as it rarely

^a See Eyre, loc. cit.

^b The only literature within our reach is that in Flüge-Mikroorganismen (5) and an article by Kartulis (3).



FIG. 145.—PHOTOGRAPH OF MISS B.'S HAND, TAKEN AT A TIME WHEN GANGRENE OF FOREFINGER HAD SET IN.



FIG. 144.—PHOTOGRAPH OF DR. W.'S HAND, TAKEN WHEN RETROGRESSIVE CHANGES HAD SET IN.

grows upon agar smeared with human blood, the best medium being human serum agar. According to Kartulis (3), "When incubated at a temperature between 28° to 30° C., the growth is first visible to the naked eye in a period of thirty to forty hours. At first it appears along the line of inoculation as small grayish-white points. Gradually the points unite into a small streak which is raised considerably above the surface of the medium. At this time the culture becomes glossy, and darker in color. The borders are uneven and well formed, and very much indented. For a long time the growth retains the described form, but it dries gradually, and then resembles the backbone of a fish. Growth upon agar-agar and gelatin is feeble. Gelatin is not liquefied. Microscopically, in a very young culture the bacillus appears somewhat plumper than those in the cells; in a very old culture they are somewhat longer and thicker. Spore formation has not been observed."

Pathogenicity.—"Transmission to the conjunctiva of animals is unsuccessful. Kartulis has obtained positive results in human beings in only one case out of six, and that with cultures 10 to 20 generations old. Weeks, on the other hand, reports several successful inoculations into human beings. His cultures, however, were not pure, but contained, besides the conjunctivitis bacillus, Xerosis bacilli (diphtheria group)" (5).

Other organisms described as resembling the Koch-Weeks bacillus.—"Another organism exceedingly like the previous, apparently differing from it only in the rather wider conditions of growth, is Müller's bacillus" (6).

"*Bacillus pseudoconjunctivitis* (5).—Discovered by Kartulis in the conjunctival secretions in a case at Alexandria, and turned over to the author. These bacilli are nonmotile and just as small as the preceding ones, and likewise neither stain, according to Gram, nor form spores. Their cultures are rather prolific, with a canary-yellow pigmentation. The gelatin cultures liquefied first, although quite slowly, but later the liquefaction disappeared and the needle-point cultures assumed the form of a nail, with flat canary-yellow heads. On potatoes a well spread out, light-brownish deposit was formed.

"*Bacillus aeris minutissimus* (5) was obtained by Drs. Jbrahim Bey and Faud Bey in the air at the Institute of Hygiene, in Bonn. It is similar to the preceding ones, but forms a light-yellowish pigment. It is not pathogenic for animals.

"*Bacillus aureus minutissimus* (5).—Also isolated by Jbrahim and Faud on plates exposed to the air. Morphologically similar to the preceding ones, but motile; does not stain, according to Gram; does not form spores; liquefies gelatin. On potatoes it forms a luxuriant golden pollulation. It produced septicæmia in mice and abscesses in rabbits."

We are inclined to consider the organism isolated from Miss B.'s finger as identical with or as a closely related type of the Koch-Weeks bacillus. In addition to its similar morphology, the difficulty with which it was cultivated and the characteristic delay in the appearance of the growth speak for such an identity. We may have slightly overestimated its size, for ocular micrometry is a rather inaccurate method. As to the limits of accuracy in micrometry, a competent authority says: "I assume that 0.2μ is the limit of precision in microscopic measures, beyond which it is impossible to go with certainty."^a Further, if the statement by Abbe be true (quoted from Lehmann & Neumann) that the limit of microscopic vision lies between 0.1 and 0.2μ , then obviously the diameter given by others for this bacillus—i. e., 0.25μ —is too small.

We have further found the bacillus to be actively motile when taken from a recent culture on ascitic fluid agar and suspended in bouillon. However, it is nonmotile when grown upon the ordinary media.

The ability to produce pigment, and a greater adaptability to a saprophytic mode of existence, suggests a closer resemblance to the organism described as *b. pseudoconjunctivitis*, but these faculties are variable ones in many species of micro-organisms. For instance, the variability in power of pigment production shown by the staphylococcus aureus or *b. pyocyaneus* may be mentioned. Again, it has often been noticed that micro-organisms isolated from a virulent form of a disease—e. g., hemorrhagic septicæmia in cattle, or cholera asiatica—do not possess a corresponding degree of pathogenicity and grow luxuriantly upon artificial media. So it is possible that in our case we happened to obtain a growth, not of the more virulent and less saprophytic type of organisms present in the tissues, but of those that had a tendency toward a saprophytic mode of existence.

As for the histological changes which this organism is able to produce, we cannot make any definite statements. It is possible that the marked canthosis occurring in the finger of monkey No. 261 may indicate the way in which the cauliflower-like verrucoid growth of tissue, occurring in the human cases, was produced.

^a W. A. Rogers, Proc. Am. Soc. Micrs., 1883, p. 198.

REFERENCE CITED IN THE TEXT OF REPORT OF AN ORGANISM RESEMBLING KOCH-
 WERERS BACILLUS, ISOLATED FROM TWO CASES OF A PECULIAR FORM OF FEVER
 OF UNKNOWN ETIOLOGY BY WILLIAM B. WHERRY, M. D. (8) *Annals of Entomology*, 1888,
 (1) S. Gaffky, *Arbeiten aus dem Kaiserl. Gesundheitsamte*, 3, 1891, 177 and 178.
 (2) *Archives of Ophthalmology*, 1886, XV, No. 4, 6; *N. Y. Med. Rec.*, May 31, 1887.
 (3) *Cent. f. Bakt. u. Parasitenk.*, 1887, I, 289.
 (4) *Jahrbuch d. Hamb. Staatskrankenanstalten*, 3, Bd. 191.
 (5) *Fiedler-Mikroorganismen*, 1896, II, 440 and 441.
 (6) Muir and Ritchie, *Manual of Bacteriology*, 2nd Ed., 1903, 201. (Muir's article
 will probably be found in the *Wien. Med. Wchnschr.*, 1897.)

THE PANAMA CANAL AND ITS RELATION TO THE INTRODUCTION OF YELLOW FEVER INTO OUR EASTERN AMERICAN POSSESSIONS BY RICHARD P. STRONG, M. D.

The question, as Doctor Manson has fully explained, is obviously one of colossal
 importance to the Far East. In our American possessions—the Hawaiian Islands,
 Guam, and the Philippines—we shall need to be continually on our guard against the
 importation of cases of yellow fever or of infected *Stegomyia fasciata*. During the
 past year yellow fever has frequently been present in Panama; the proposed western
 terminus of the canal. Thus, from April 22 to May 12, 1902, 8 cases and 6 deaths
 were reported. From July 1, 1902, until the middle of January of this year, accord-
 ing to the health reports of the United States Marine Hospital Service, there have
 been 133 cases and 23 deaths of yellow fever in that city. As has long been recognized,
 the disease often follows the lines of commercial maritime travel. It is well known that there are frequent instances of the introduc-
 tion of the malady by vessels into hitherto uninfected regions. Good examples of
 the conveyance of the disease by ships over short distances may be seen in the infec-
 tion of the southern ports of the United States and of Mexico from the West Indies.
 Whether the West Indies were primarily infected from West Africa, or vice versa,
 must still remain uncertain. The first accredited record of yellow fever in Spain is
 that of 1730, when the disease was imported into Cadiz by a ship from Central
 America. The introduction of the malady into Brazil in 1849 occurred, it is said,
 through an infected vessel from New Orleans which landed at Bahia. Before this
 time, according to some authorities, the disease was unknown in that country. How-
 ever, others assert that yellow fever was imported into Lisbon from Brazil as early
 as 1723; and that this was its first appearance in Europe. At any rate, since 1849
 yellow fever has never been absent from Brazil. The introduction of the disease
 into Portugal by vessels from Brazil followed in 1850, 1851, and 1856. There occurred
 in St. Nazaire, in 1861, the only important epidemic of yellow fever that has ever
 broken out in France, and this was also due to infection from shipboard, as follows:
 The ship *Anne Marie* sailed from Habana on June 13. On July 1, eighteen days
 after her departure from that port, two seamen fell sick, and five days afterwards died
 of yellow fever. The epidemic then spread throughout the crew, and 9 out of
 the total number of 16 were attacked by the disease. The ship entered the port of
 St. Nazaire twenty days after the last death, and ten days after the inception of the
 final case of suspicious illness. As no case of sickness had occurred on board during
 the last ten days of the voyage, and as all were well at the time of arrival, the
 vessel and crew were not quarantined. The *Anne Marie* lay near the shore and at
 her side were moored two other vessels. Her crew were disbanded and the dis-
 charge of the cargo was intrusted to 17 stevedores, all of whom were in good health.
 Shortly after, 10 of them became sick and died of yellow fever, while 6 persons on
 shore who had been in contact with them also contracted the disease. In addition,
 yellow fever broke out on board both of the vessels which were lying near the *Anne
 Marie*, and from their others became secondarily infected. In short, the *Anne Marie*
 infected seven vessels directly or indirectly with yellow fever. In all there were 40
 cases and 23 deaths. The epidemic which occurred in Leghorn, Italy, in 1894, also owed its origin to a
 Spanish ship from Habana. During the voyage to Cadiz this ship had lost almost its
 entire crew from yellow fever. The crew was recruited at Cadiz and eventually
 arrived, after several stoppages, at Leghorn, where no quarantine was imposed.
 Two sick men were taken off the vessel and carried to hospital in the city, both of
 them dying a few days later. Shortly afterwards 12 other persons on the same ship
 were stricken with the disease. Suspicion was directed against the ship from
 Habana as the source of the trouble, and sanitary guards were stationed aboard, who

also promptly contracted the fever. The malady spread gradually throughout the city of Leghorn. The statistics of this epidemic are very conflicting; it having been variously estimated that from 700 to 1,900 persons died of the disease. While it was not admitted to be yellow fever at the time, probably for commercial reasons, Palloni, who had seen and studied the epidemic, acknowledged seventeen years later that it had really been one of yellow fever.

There are many other instances in which epidemics of yellow fever have been carried by vessels directly from one port to another, and often over great distances. One need glance only for a moment at the map and then at the statistics of cases of yellow fever in numerous seaport towns during the past year to be again impressed by the relationship existing between commerce and yellow fever. During the past year among the seaport towns of the eastern coast of the Western Continent, Port Linon, Progreso, Vera Cruz, Tuxpan, Tampico, Rio de Janeiro, Bahia, Matlaos, Pernambuco, Para, and Paramaribo, and among those on the western coast, Panama, and Guayaquil have all been frequent sufferers from this scourge. It does not seem improbable, therefore, that unless extreme precautions are taken against vessels passing from these regions and bound for ports in the Far East, infected ships, and even cases of yellow fever will be conveyed from the above-mentioned cities to Honolulu, or even directly to Guam, Hongkong, and the Philippine Islands.

I would remind you that as late as 1865 a sailing vessel arrived at Swansea from Santiago de Cuba, on board of which yellow fever broke out while in port, and caused the death of 15 persons. It is well known that it is not an uncommon occurrence for vessels to arrive in Italian ports from South America with a history of yellow fever on board during the voyage. With these examples in view does not the argument seem reasonable that the same thing might take place in Asiatic ports owing to the increased traffic between them and the endemically infected regions? The distance from Panama to Honolulu is 4,692 miles, which is about the same as that from Bahia to Naples, and less than that from Rio de Janeiro to Naples. Mail steamers from Panama should reach Honolulu in thirteen or fourteen days, and the Philippine Islands by a direct route in about twenty-eight days. Vessels, even though leaving Panama with no cases of yellow fever on board, and reaching Honolulu without a history of sickness en route, yet might obviously be most serious agents of infection to the Hawaiian Islands, for if *Stegomyia* which had recently bitten persons suffering with yellow fever were taken on board the ship at Panama (as the late Doctor Reed has shown) they would not be capable of conveying the disease until about twelve days later, which at the earliest would be one or two days before the arrival of the ship in Honolulu. Stevedores sent on board at Honolulu to unload the cargo might be bitten by these insects and could later convey the disease to others in the Hawaiian Islands. The same might occur in Guam or the Philippines, for ships might also arrive at these ports with no cases of yellow fever on board, and without a history of the disease in route, and yet contain infected *Stegomyia* which, concealed in the hold or in other places unfrequented by the passengers or crew, had not had the opportunity of feeding upon susceptible individuals during the voyage. H. R. Carter has reported six such instances. On these occasions yellow fever appeared respectively on the eleventh, twelfth, thirty-eighth, sixty-fourth, and sixty-eighth days after the departure of the ship from the infected area. It has been shown that the *Stegomyia* is capable of conveying the disease at least as late as fifty-one days after biting a person suffering with the disease, and it would therefore still be dangerous for many days after the arrival of the vessel in an eastern port, whether it remained on board or escaped to land.

The question whether the *Stegomyia fuscata* could be kept alive during a voyage of such duration is easily answered in the affirmative. Reed, however, pointed out that free access to water is necessary to the existence of this mosquito and that when deprived of it it dies in from five to six days. There are many instances in which mosquitoes have been carried great distances at sea, and the *Stegomyia* is frequently found on board ships in tropical ports. Doctor Cummings, of the United States Marine Hospital Service, reported that a Spanish barque, sixty-five days out from Rio de Janeiro, arrived at the South Atlantic Quarantine Squadron with a veritable plague of mosquitoes, most of which belonged to the species *Stegomyia fuscata*. According to the captain's statement the mosquitoes had been present on board the ship during only forty-three days. In the water tanks of this vessel great quantities of the larvæ were found, showing that the insects were propagating and multiplying

In thirteen cases of experimental yellow fever, Reed and the army commission showed that the incubation period varied from forty-one hours to five days and seventeen hours. This agrees with the incubation period as clinically observed in a large number of cases by various observers.

From the Institute for Infectious Diseases
(Lect. Prof. Dr. H. Koch.)

on board. I have cited above, at some length, two instances in which yellow fever was carried in vessels over great distances and for long periods of time. In the first instance the ship *Anne Marie* carried the infection from Havana to St. Nazaire. It will be remembered that this vessel entered the port ten days after the last case of yellow fever had appeared and that all on board at the time were well. The infection of the stevedores and others immediately following must have been due to the infected *Stegomyia* on board the vessel. The history of this epidemic has been carefully explained in this light by H. de Gousea. (*Le Bulletin Médical de Paris*, Oct. 12, 1901). While it may be argued that, as yellow fever has been successfully kept out of Italy since 1883, no cases having been registered on shore since that date, although cases of the disease frequently arrive in Italian ports, the question of its exclusion from our coast cities in the Far East probably will be an equally simple one. It seems likely, however, that the climatic and hygienic conditions in Europe are not as favorable to the development of this disease, and that moreover the ports I have particularly mentioned, viz, Honolulu, Guam, and those of the Philippine Islands, all lie within from 10° to 20° north latitude, while the Italian ports are almost all above 40° north.

Again, with a greatly increased maritime traffic between the endemic yellow fever ports and the East, the danger becomes manifold, and each ship so en route further increases the risk. Should, moreover, a case of yellow fever (or even infected *Stegomyia*) reach Manila, without quarantine, the chances would seem to be in favor of its not falling upon barren soil. Humidity and heat, which seem to be the ideal coefficients for the preservation of the disease, are always present in Philippine ports. The *Stegomyia fasciata* is found abundantly throughout these islands, and one may at any time readily obtain in a few minutes a number from any of the dwelling houses in Manila. Again, in the Philippine ports there will be no oncoming of cold weather to check the spread of the epidemic, a factor which hitherto seems to have been of most importance in the disappearance of the disease at various times in the United States. Since the *Stegomyia*, as well as the conditions favorable for its propagation and development, are to be found everywhere the year round, an epidemic once started here among a people of perhaps no marked immunity to the disease would probably end only when no further susceptible material existed.

But while it has seemed wise to emphasize the great importance of this subject to these people, and the greater risk of infection with yellow fever upon the opening of the Panama Canal, in the light of recent results the matter has not altogether a dark side. For example, Wood and Gorgas, stimulated by the work of the late Walter Reed, have recently shown us that it is possible by proper sanitation to entirely stamp out yellow fever from its natural endemic home, Habana, a place from which, as Doctor Manson, writing in 1898, has said, "The disease is never absent." Having shown that the extermination of the malady is practicable in such regions, why, then, should not the same be accomplished along the entire route of the Panama Canal? It does not seem too much to hope that this will be brought about and that before the opening of the canal there will be little danger of infection from its shores or from its terminal port.

A PRACTICABLE CHOLERA VACCINE AND ITS METHOD OF PREPARATION.^a BY RICHARD P. STRONG, M. D.

For the past several months I have occupied myself with the task of preparing a practicable vaccine against cholera. As it is necessary for me to interrupt my studies on this subject for a time, and as the results already obtained seem favorable, it has been thought advisable to publish a very brief account of some of the experimental work.

While apparently there is little or no reason to doubt that human vaccination against cholera with either the Perran-Haffkins or the Kolle method, when properly applied, gives rise to a good immunity, there is nevertheless little hope that either method will ever become a general one on account of the severe local reaction and the constitutional symptoms which usually follow the administration of each. Indeed, Kolle himself admits that these methods are far too severe for practical use.

In my search for a practicable vaccine I first studied the local reaction and other toxic effects produced in animals after the injection both of a very virulent cholera culture and of one which through cultivation on artificial media for a long period of time (nine years) had lost most of its virulence. The effects of the killed as well as

^a From the Institut für Infektionskrankheiten in Berlin. (Director: Geh. Med.-Rath. Prof. Dr. R. Koch.)

of the living organisms were also studied with each culture. These two stems, for the sake of brevity, will be referred to in the article as "virulent" and "avirulent."

Some time was spent in accurately standardizing these cultures, and the minimal lethal dose for guinea pigs of 250 grams weight was carefully determined. After numerous passages of "virulent" through animals a minimal lethal dose of one-tenth of a standard dose of a twenty-four-hour agar culture was reached. Such a dose of "virulent" suspended in 1 c. c. of an 0.85 per cent solution of sodium chloride and injected intraperitoneally into a guinea pig of 250 grams weight, regularly caused death within twenty-four hours. With "avirulent," on the other hand, one and one-half of a standard dose of a twenty-four-hour agar culture injected intraperitoneally were required to produce death within this time in such an animal. The former stem, therefore, may be said to possess fifteen times the virulence of the latter. Throughout the course of the work this relation between the organisms was carefully preserved and continually tested by animal inoculation. As the virulence of cholera cultures changes in a few days on laboratory media it is necessary to make daily inoculations and always to use the same generation of the stem.

It soon became evident that the local reaction upon the tissues in animals after the subcutaneous injection of "avirulent" was much less than after one with virulent cholera spirilla. I therefore decided to determine the character of the serum which could be produced with this avirulent organism and to compare it with the one produced by the virulent germ. Accordingly, a series of six rabbits of an average weight of 1,500 grams each was inoculated intravenously, three each with one-half oese of "virulent" and three each with one-half oese "avirulent," the organism in every instance being suspended in 1 c. c. of normal saline solution. After seven days the rabbits were all killed by bleeding and the value of the serum in each case determined for agglutinative and bactericidal properties. It was then seen that the rabbits inoculated with the virulent culture always furnished better serum than those inoculated with "avirulent," but that the value of the serum from animals treated with the former in both bactericidal and agglutinative properties was in no case more than twice that of the serum furnished by animals treated with "avirulent." The technique used in these experiments was as follows:

The reactions for agglutination were performed in the test tube. One oese of the living organisms was thoroughly emulsified with 1 c. c. of an 0.85 per cent solution of sodium chloride. The diluted serum suspended in 1 c. c. of a similar saline solution was then added and the mixture placed for two hours at 37° C. In a complete agglutination the liquid overlying the precipitated bacteria should appear entirely clear.

The bactericidal reactions were performed in the abdominal cavities of guinea pigs after the well-known method of R. Pfeiffer. The dilutions of the serum were made in normal saline solutions. One c. c. of the diluted serum was then added to 1 c. c. of bouillon containing one oese of "virulent" in suspension, after which 1 c. c. of the resulting mixture was injected into the peritoneal cavity of a guinea pig, the animal thus receiving five times the fatal dose of living organisms. A fresh guinea pig was used for each reaction, which was controlled by microscopical examination of a drop of the contents of the abdominal cavity (obtained by means of a capillary tube) as well as by the inoculation of control animals without serum. The result to the animal after twenty-four hours, whether living or dead, was regarded as the final test, though the condition of the organisms in the abdominal cavity was always carefully noted.

As an outcome such as was obtained in the foregoing experiments was not entirely unexpected, but as the results were somewhat at variance with the ideas of Haffkine, and quite different from what R. Pfeiffer found upon the intravenous injection into rabbits of dead cholera spirilla of different degrees of virulence, it was determined to repeat them. Accordingly, the second series of animals was inoculated just as the first, and on the day of inoculation, as in the previous series, the virulence of the injected organisms was verified as fifteen to one. The result was practically the same, for at the end of seven days the examination of the sera showed that the virulent stem had in only one case given a serum of more than twice the bacteriocidal value of that produced by the avirulent.

In this one case the avirulent serum was one-fourth as strong.

In the experiments performed with the subcutaneous injection of the avirulent organism, in both the living and the dead state, while the local reaction, as already mentioned, was much milder than with the use of the virulent germ, there was always considerable inflammation about the point of inoculation, and it soon became evident that it would be highly desirable to do away entirely with the bacterial cells if possible. I therefore occupied myself with the problem of extracting the immunizing properties from the bacterial bodies.

After the trial of numerous methods it was found that by the autolytic digestion of the killed spirilla in aqueous solutions the cholera receptors were set free in the fluid in great abundance, and after filtration were easily demonstrable by the fact that such filtrates possessed the power to bind the cholera uni and amboceptors (agglutinins and bacteriolysins) in a cholera-immune serum, as well as by their power after injection into rabbits of giving rise to the appearance of bactericidal, agglutinative, and antitoxic substances in the blood of these animals. Such a filtrate therefore immediately recommended itself for trial as a protective inoculation. After its efficacy as a vaccine had been demonstrated by numerous animal experiments the cholera receptors were obtained in solution in large quantities after the following manner:

The surfaces of large flat-sided flasks, filled with agar, were sprayed with twenty-hour bouillon cultures of the organism and the flasks then put aside in the incubator at 37° C. for twenty hours.^a After this period the growth was emulsified with sterile water, removed from the surface of the agar, and the emulsion placed in a sterile flask at 60° C. for two hours. The mixture was then put aside in the incubator at 37° C. for from two to five days. The best results were apparently obtained after five days of autolytic digestion, at the end of which the emulsion was filtered through a Reichel candle. The fluid thus obtained must, of course, be examined for sterility and carefully standardized before using as a vaccine.

By means of the intravenous injection into rabbits of 1 c. c. of such a filtrate (representing the amount of receptors obtained from two oese of "virulent" after two days of digestion) there was obtained at the end of seven days a serum equal in bacteriocidal and agglutinative properties to that obtained by the injection of one-half oese of the living virulent cholera organism. Following the intravenous injection of 6 c. c. (obtained from 12 oese after five days' digestion) a serum of double this strength was obtained, such that it agglutinated in dilutions of 1 to 800 and showed a bacteriocidal reaction of 1 in 24,000. Rabbits received large intravenous injections of as high as 12 c. c. of a filtrate not too concentrated and but slightly showed the effects of the inoculation. Usually there was about one degree of temperature on the day following the inoculation. If, however, the solutions of the filtrate were too concentrated, death sometimes resulted. The injection of the filtrate obtained from the digestion of the avirulent stem likewise gave rise to immunizing properties in rabbits, and the serums obtained were from one-fifth to one-twelfth as strong as those produced by the injection of corresponding amounts of the virulent filtrate. In either case the filtrate might be evaporated in a vacuum at 37° C., and when dissolved in water and injected either subcutaneously or intravenously gave rise to a good immunity, although the results obtained were not so excellent as those following the use of the filtrate before evaporation.

I have repeatedly injected from 1 to 5 c. c. of virulent vaccine filtrate subcutaneously into a large number of both guinea pigs and rabbits practically without any signs of the appearance of a local reaction. A small guinea pig inoculated intraperitoneally with 5 c. c. of virulent filtrate died after twenty-four hours, but there were no evidences of injection of the blood vessels at the point of inoculation, neither were there any signs of injection or hemorrhage in the peritoneal cavity, but only a marked cedema of the abdominal walls. However, $\frac{1}{2}$ c. c. of the precipitate remaining behind on the filter, in the form of an emulsion, gave rise to the death of guinea pigs with the presence of an extensive local reaction, injection of the vessels, and corrosion of the tissues. On the other hand, the injection of 1 c. c. of virulent vaccine filtrate perfectly and regularly protected guinea pigs after one week against the injection of five times the fatal dose of cholera spirilla. As a passing example of its value as a vaccine may be mentioned an experiment in which four large guinea pigs were inoculated, two receiving $\frac{1}{15}$ oese of virulent twenty-four hour agar culture, and the other two 5 c. c. of virulent vaccine filtrate intraperitoneally. After six days all were inoculated with 2 oese of "virulent." The two which had received the vaccine filtrate lived; the other two died. From these experiments it is easy to see that we have a very efficacious form of vaccine, and apparently one which gives rise to almost no local reaction. In fact, through the kindness of Professor Wasserman, I recently received a subcutaneous injection of a quantity of such filtrate corresponding to $\frac{1}{15}$ oese "virulent," practically without the appearance of any local reaction.

Naturally, during the course of this work the question often recurred to me upon what property the difference in virulence (15 to 1) between my two stems, virulent and avirulent, depended. Without going into detail here, it may be said that it was

^a Cultures of twenty hours' duration were always used, because it has been found that the maximum growth of cholera cultures at 37° C. is obtained within this time. After this period a rapid death of spirilla in culture media takes place.

possible to show that in a cholera-immune serum (agglutinating and bactericidal) both of rabbits and guinea pigs, the virulent organism bound from fourteen to sixteen times as many cholera amboceptors as did the avirulent one, or, in other words, the virulent germ either possessed from fourteen to sixteen times as many receptors as the avirulent one or had from fourteen to sixteen times as great an affinity for the cholera amboceptors in its haptophore group. Experiments to determine the difference between the number of receptors possessed by the killed organisms of both stems and also the difference in the number of the receptors possessed by the filtrates obtained by autolytic digestion from each will be described in a later paper.

The use of free receptors obtained by autolytic digestion and filtration as a vaccine in other diseases, as, for example, typhoid fever and dysentery, along the same lines as I have described for cholera, naturally suggests itself. However, whether autolysis will furnish as satisfactory a vaccine with the bacilli of typhoid fever and dysentery as with the spirilla of Asiatic cholera can be determined only by actual experiment. Comradi, Neiser, and Shiga have recently suggested the use of such a method for the preparation of a curative serum in typhoid fever and dysentery. As autolytic digestion does not always give constant results with all bacteria, one is not to be discouraged by a few failures in the use of this method. Its success, perhaps, largely depends upon the fermentative power of the organism and upon the number of receptors it contains. It is my intention, if possible, shortly to make use of my vaccine in the epidemic of cholera now existing in the Philippine Islands.

In regard to the preparation of a vaccine against Asiatic cholera, I wish to add that if one accepts spirilla found in water, or even in the intestines of those who have died of cholera, and which, for example, possess more than a single terminal flagellum, or those which kill pigeons, etc., as examples of the genuine *Spirillum cholerae asiaticae*, without having very carefully tested these organisms with an undoubted cholera-immune serum in dilutions reasonably near the agglutinating limit, and, further, if one uses such organisms in the preparation of a protective vaccine, I do not believe that very satisfactory results against Asiatic cholera can be obtained. The selection of a correct spirillum for the preparation of a vaccine is obviously of the greatest importance, and should be made with particular care. Finally, it is probable that several varieties of spirilla, such as I have referred to above, and which give characteristic growths for cholera organisms on artificial media, or even stems, such as "avirulent," may be swallowed by human beings with impunity; but I am not at all convinced that the same may be performed with very virulent stems of true *Spirillum cholerae asiaticae*. Our experience in Manila has shown us that the genuine cholera spirillum is not nearly so variable in its serum reactions, growth on artificial media, and pathogenicity as might be supposed from some of the literature on the subject.

In conclusion, I wish to express my thanks to Prof. A. Wasserman, in whose department of this institute the work was performed, for many valuable suggestions during the course of my study. Whatever benefit may come from the use of this vaccine will in greater part belong to him.

REPORT OF THE BOTANIST OF THE BUREAU OF GOVERNMENT LABORATORIES, MR. ELMER D. MERRILL, FOR THE PERIOD COMMENCING JULY 1, 1903, AND ENDING AUGUST 31, 1903.

Botanical work under the American auspices was commenced in April, 1902, in the bureau of agriculture at the time of its organization. In July of the same year, by an act of the Civil Commission, in addition to my duties as botanist in that bureau, I was also made acting botanist to the bureau of forestry; while on July 28, 1903, by act of the Civil Commission, I was transferred with all botanical work to the bureau of government laboratories, the object of this transfer being to bring the scientific work under one head as far as possible, so as to avoid duplication of libraries and equipment.

Reports on the work accomplished from July 1, 1902, to July 1, 1903, have been submitted to the chiefs of the bureaus of agriculture and forestry.

Pending the action of the Commission in the matter of the transfer I remained in the bureau of agriculture until August 1, on that date transferring all office equipment, botanical books, and herbarium to this office. This material, the property of the bureaus of agriculture and forestry, should be officially transferred to this office at the earliest possible date.

ORGANIZATION.

In the organization of the botanical laboratory the work should be planned to follow broad lines, and not be confined to any one or two fields of work, but rather be planned to cover all branches of botanical investigations. The botanical library and herbarium, the basis of all accurate work, should be built up as rapidly as possible; provision should be made for work in pathology, morphology, vegetable physiology, histology, ecology, etc., and at the same time systematic botany should not be neglected. At the present time the greatest need in the botanical investigation in the Philippines, is a thorough inquiry into the systematic botany, for much of the work in other branches, not only of botany, but also in forestry, agriculture, chemistry, and entomology is, to a greater or less extent, dependent on systematic botany. Following the plans of the botanical institutions established in the Tropics by the English and the Dutch, provision should be made for granting the facilities of this laboratory to such American and European botanists who may desire to work on a tropical flora. The leading educational institutions in America should be notified of the facilities offered by the laboratory for work in all lines of botanical investigations, and an attempt should be made to attract those botanists who desire some knowledge of the tropical flora and those candidates for advanced degrees searching for subjects or materials on which to prepare their theses. The plan of the United States Department of Agriculture, providing for the position of "scientific aids," at a nominal salary, has much to commend it, and, it is believed, would be entirely practicable here.

To logically carry out the plans of the Civil Commission regarding the botanical investigations in the Philippines, which resulted in the transfers from the bureaus of agriculture and forestry to this bureau, all botanical work should be done in this office, and other bureaus should cooperate with us in building up our working herbarium. At the present time there are three distinct bureaus in the department of the interior, all urgently in need or the services of a botanist, and the plan of the Commission to have all the botanical work done in one office is the most logical one, in order to avoid the expense of duplicating botanical books and equipment. However, it is impossible for one or two men to do all the work necessary, and it is hoped that a sufficient number of assistants will be provided.

The forestry bureau is at present in the greatest need of the services of a botanist, and during the past year the greater part of my time has been spent in the interests of that bureau. As the organization of the botanical laboratory is completed and assistants become available, a division of forest flora investigations should be established and certain assistants assigned to this most important branch. Pending the complete organization of the botanical laboratory our chief attention should be given to the work on the forest flora.

ASSISTANTS.

By understanding with the honorable, the Civil Commission, in July, 1903, measures were taken to find an assistant and two collectors for the botanical laboratory, and it is hoped these will be authorized and be able to report for duty within two or three months. In addition to these assistants, native collectors, should be employed, and provision should be made for an adequate clerical force in the office. One clerk who can operate a typewriter is urgently needed, a position of "curator" should be established, whose duties should be to prepare material for the herbarium, to oversee the poisoning and mounting of specimens, to distribute material in the herbarium, to distribute duplicates, to complete labels, etc., in order to relieve me of this routine work and give me opportunity to devote my attention to more important matters. Native assistants for poisoning and mounting specimens are essential, and this work will be greatly increased in the near future.

BOTANICAL LIBRARY.

The botanical books at present available have been purchased by the bureaus of agriculture and forestry, and an additional list has been sent to dealers from the bureau of government laboratories, so that we soon will be in a position to have a very creditable nucleus for an extended botanical library.

HERBARIUM.

At the time of the transfer of the botanical work to this bureau, the herbarium contained 5,061 mounted specimens, the property of the bureaus of agriculture and forestry. Since then there have been added 133 specimens secured by employees of

the forestry bureau, 90 Philippine specimens collected by employees of the bureau of agriculture, 200 specimens received by the bureau of agriculture from the botanical garden at Calcutta, and 858 specimens received by the forestry bureau from the botanical garden at Buitenzorg, Java. The total number of specimens in the herbarium at present is 6,342.

PUBLICATIONS.

The publications prepared during the past year, while the botanical work was in the bureau of agriculture, are as follows:

Bulletin No. 4, bureau of agriculture: "Botany in the Philippines" an historical review of the botanical work accomplished on the Philippine flora.

Bulletin No. 1, bureau of forestry: "Report on investigations in Java in the year 1902." This consists of a report on my trip to the island, an enumeration of the Philippine plants identified, a report on the methods employed in investigating the forest flora of Java, and a report on the botanical garden at Buitenzorg.

Since my transfer to this office I have completed and presented for publication, as a bulletin of this bureau, two articles: The first, "New or noteworthy Philippine plants" consisting of descriptions of some new species, notes of nomenclature, etc.; the second, "The American element in the Philippine flora," consisting of an enumeration, and a discussion of the many plant species of American origin now known to grow in the Philippines.

Work on a dictionary of the native plant names, commenced some months ago, while I was in the bureau of agriculture, has been continued, and at the present time the manuscript is nearly ready for publication.

MISCELLANEOUS WORK.

During the past two months, considerable botanical work has been done for the Philippine exposition board in identifying material, correcting manuscripts referring to botany, agriculture, and forestry, and in preparing a chapter on "botany" for a publication of the exposition board, entitled "A description of the Philippines," and also a list of Philippine timber trees for the same work.

For this bureau work has been done on the identification of the gutta-percha and india-rubber producing plants found in the archipelago, and also many identifications of tan barks, dyewoods, gums, resins, etc., much of the latter work being in the interests of the forestry bureau and the exposition board.

For the forestry bureau reports on collections have been submitted as they have been received. The species have been identified so far as possible to name them from the material submitted.

THE NECESSITY FOR ESTABLISHING A BOTANICAL GARDEN OR A SIMILAR INSTITUTION.

To meet with the greatest amount of success in office and laboratory work the early establishment of that essential adjunct, a botanical or experimental garden, is most important. For systematic botanical work such an institution is essential, as it gives us an opportunity to collect material, buds, flowers, and fruits from the same plant in all stages of development, and accordingly enables us to draw up complete descriptions. In an ordinary field trip it is, in the majority of cases, impossible to collect complete material, for the reason that comparatively few plants bear flowers and ripe fruit at the same time, and on trips extending over a short period it is impossible to spare the time necessary to allow one or the other to develop. For work in morphology and embryology it is absolutely essential that the species on which work is being done be accessible to the worker, in order that he may prepare his material covering all stages of development of the plant. The laboratory work on dyes, tans, medicinal plants, gums, etc., is directly dependent on authentically named material, and this material can best be secured by cultivating a sufficient number of specimens of each species to supply material for laboratory work. Careful and long-continued investigations on gutta-percha trees, rubber trees, etc., can only be carried out where the growing trees are available, and in such a garden all the species procurable should be cultivated. Economic plants from the Tropics of the world should be cultivated, with a view to their possible introduction.

The proper location of such an institution is most important. That it should be readily accessible from Manila is essential, and yet at the same time it must be located considerably above the sea level and preferably in a hilly country where the soil is fairly rich, and where rainfall is abundant and fairly well distributed through the year; moreover, sufficient water for irrigation purposes must be available.

The station for forest investigations about to be established by the chief of the forestry bureau at Lamao River, Mount Mariveles, is admirably adapted for that

purpose, but is not suitable as a botanical experimental garden on account of its inaccessibility. The present condition of the so-called botanical garden in Manila, is proof that we can not hope to establish a successful institution of this kind in the immediate vicinity of the city, and accordingly it is recommended that the region about Antipolo, province of Rizal, be thoroughly investigated, with a view to establishing an experimental garden at this place. It is believed that this location, all things considered, is the best that can be found, and, moreover, within a few months, when the railroad is completed to that point, will be readily accessible from Manila.

EXHIBIT D.

**REPORT OF MR. CHARLES S. BANKS, ENTOMOLOGIST, FOR THE YEAR ENDING
AUGUST 31, 1903.**

I assumed the duties of this office on the 9th of December, 1902, and began at once a preparation of library and apparatus lists to be sent abroad for obtaining the material necessary for the prosecution of entomological investigations.

On the 27th of December I started for Negros, by order of the superintendent of government laboratories, to take up the investigation of insects affecting the cacao plant. Much of the material necessary for the work of collecting and studying insects was drawn from a small supply which I had brought from the United States; such other material as was obtainable in Manila, including photographic plates and certain instruments and tools for use in the plantations, was also carried with me.

My work in Negros covered a period of about twelve weeks of active field investigation and collecting of material. Through the courtesy of a Filipino friend with whom I had lived for a little more than a year, I was enabled to make my headquarters within very easy reach of his large cacao orchard, where I had every opportunity to study the trees, and the insects affecting them, under the most favorable conditions possible.

From this place as a base I was enabled to visit many of the surrounding towns to study conditions of cacao culture and the prevalence of insect pests. The following places, in addition to Nakalang, the place where I worked, were visited, viz: Hacienda Prudencia, Makakati, Las Delicias, Murcia, La Carlota, Pontavedra, Hacienda Concordia, San Carlos, Hacienda San Vicente, and Valle Hermoso.

All the work of developing photographs and the rearrangement and packing of material was done at the Hacienda Louisiana, the home of Señor Don Juan A. Araneta, to whose aid I owe much of the success of my work.

My work at Nakalang included the collection of all insect and myriapod life found in connection with the cacao, whether known to be harmful or not. In addition to this, biologic and ecologic studies were made with those insects for the study of which the season presented the most favorable opportunities.

More than one hundred species were found upon the cacao, either as injurious, beneficial, or neutral forms. Of these, only the most important have been treated in my report.

In addition to the collection of about 3,000 specimens from the cacao, a large amount of general material was gathered by myself and my helpers, and the total number of specimens thus added to the collection will be about 8,000.

The principal results of the work in Negros have been a more thorough knowledge of the forms of insects attacking the cacao and a better understanding of the best methods of preventing or combating their ravages.

The locust pest has been reported from many provinces, including Tayabas, Abra, Lepanto-Bontoc, Rizal, Capiz, Negros Occidental and Negros Oriental, Laguna, Batangas, and has probably been prevalent to a greater or less degree in every other province in the archipelago.

As yet the locust fungus can not be said to be effectual against the hordes found here. On the 6th of May I went to the province of Abra, where it was claimed that the locusts were doing great damage. A two-weeks trial with the fungus resulted negatively as far as its efficacy with swarms of locusts was concerned. Other experiments carried on by the board of health and by individuals have given practically the same results. I shall, however, take up this subject at the earliest moment and by careful experiments in breeding and a study of the anatomy, physiology, and biology of the insects determine if the fungus can not be made effective upon them, not only as individuals, but by producing an infection which will become enzootic, or at least contagious, over more than one generation. As far as Philippine locusts are concerned, nothing is yet known of the pathologic effects of the fungus. We know

that in the laboratory they have died within a reasonably short time after inoculation when a certain degree of humidity was maintained, but that is all."

Requests have come to me for the determinations of mosquitoes, flies, and a few other insects during the period since I began work. These requests have been complied with as far as the literature and identified material at hand would permit. Very little general classification has been attempted thus far, owing to the lack of literature, but when the large order of books which have been sent for arrives, more work along this line will be done. Already there has accumulated a large amount of material which, when properly mounted and classified, will form a nucleus for a very respectable collection. As yet the inauguration of entomological work has not become generally known in the provinces, but I have no doubt that as soon as farmers realize that they have a place where they may send material for identification they will avail themselves of the services of the entomologist for this work, and we will thereby become familiar with conditions as they exist throughout the islands.

Early in June, Mr. J. L. Webb came to this laboratory as assistant entomologist. He was designated to study the forest insects of the islands, and during his investigations collected a considerable amount of material, which will be worked up at the earliest moment. Owing to ill health he resigned his position on the last of this month to return to America, having worked a little more than two months and a half.

In the new temporary quarters of the biological laboratory facilities have been provided for the entomological work and for storing the collections until the new laboratory building is completed, where ample quarters have been appointed for the entomologist and his staff, which is to be augmented as needs require.

Many friends in Manila, a list of whom is given elsewhere, have donated useful material to the collection, but owing to pressure of other work the entomologist has had no time to give to field excursions around the city. It is hoped soon to get a representative collection of all insects found in the vicinity of Manila.

The collections planned may be divided into three classes: (a) Biologic collection, giving the stages and work of economic forms; (b) systematic collection, having as its ultimate end the classification of all insects of the Philippines; (c) display collection, intended for public exhibition in the new building, where a suitable place will be provided. At present most of the material is in vials and in Schmidt insect boxes made in Manila.

A list of the most important books on Philippine and general entomology will soon be added to the entomological laboratory, and a number of periodicals have been placed upon our subscription list. Among the most noteworthy are a complete set of the publications of the Entomological Society of London, Catalogues of Insects in the British Museum, Insect Life Complete, Fauna of British India, Coccidæ of Ceylon, Rhopalocera Nihonica, Rhopalocera Malayana, Hemiptera Insularum Philippinarum. It is hoped to build up an entomological library which will not be surpassed in the East as an aid to entomological students of this part of the world. So far the entomologist has depended almost entirely upon his private library for data and the classification of material brought in.

The insect fauna of these islands is closely related to that of Java, Australia, Borneo, Sumatra, Celebes, and, possibly in some orders, to India and eastern Asia.

As comparatively little work has thus far been done on Philippine entomology there is open for this department a new and virgin field, but the time will eventually come when material will have to be taken to Singapore, Java, or Europe for identification because of the impossibility of identifying a great deal of it without access to types.

The advisability of giving serious attention to the offer of Mr. Georg Semper, of Altona, Germany, to sell his fine collection of Lepidoptera of the Philippines, together with his author's copy of his book in thirteen volumes on the butterflies and moths of the Philippines, is here urged most earnestly because of the great value which such a collection would have, containing as it does 1,400 distinct species, of which 340 are types. As this collection is of inestimable value to entomologists here, it should find a permanent place in a museum of the Philippine Islands instead of in Europe.

The laboratory insectary is yet in its infancy, but when permanent quarters are secured the rearing of economic forms of insects will be given considerable attention and proper facilities will be planned for rearing plants and the insects which infest them.

"Results from the fungus this year are much less satisfactory than those obtained during the preceding one. The reason for this it is difficult to give at present, as even new fungus obtained from Africa did not behave differently. The weather conditions apparently have much to do with the results.

The entomologist is at present working upon a bibliography of Philippine entomology and that of the adjacent countries, with a view to aiding those who wish to refer to any special subject treated by writers on oriental entomology. He is also preparing an index to C. Stål's valuable work, "Hemiptera Insularum Philippinarum," the purpose of which is to render this work more useful and accessible to investigators.

In planning the work for the coming year, it is proposed to give some attention to the flies and mosquitoes of Manila and vicinity, with a view to determining their relation to disease both of man and animals. It is also planned to inaugurate a system of field observers in the various provinces, enlisting therein the cooperation of the American school teachers, hacenderos, and others interested in the subject of agriculture in the Philippines.

Data are being collected for a bulletin on household insects and those injurious to commercial products in the Philippines.

The entomologist has been requested by the Philippine exposition board for the St. Louis Exposition, through the chief of the bureau of government laboratories, to prepare an exhibit for the Louisiana Purchase Exposition at St. Louis in 1904, and steps have already been taken for its preparation. Cases and all necessary material will be supplied by the board, but in order to carry this work to a successful termination it will be necessary to enlist the aid of collectors in all parts of the archipelago by paying for the material furnished by them.

The entomologist wishes to acknowledge his obligations to Dr. L. O. Howard, United States entomologist at Washington; Prof. J. H. Comstock, of Cornell; Mr. Charles P. Lounsbury, Government entomologist, of the Cape of Good Hope; Dr. A. D. Hopkins, of the United States Department of Agriculture; Dr. James Fletcher, Dominion entomologist of Canada, and Mr. C. P. Gillette, entomologist of the Colorado Experiment Station, for their kind offers to identify material from the Philippines.

Insects received December 9, 1902, to August 27, 1903.

	Specimens.	Species.
Sr. Juan A. Araneta, Maaao, Negros Occidental:		
Lepidoptera (224 larvæ, 12 pupæ, <i>Noctua</i>)	35	25
Hymenoptera	3	3
Coleoptera	2	2
Hemiptera	75	2
Diptera	4	3
Odonata	1	1
Orthoptera	5	1
Frank J. Dunleavy, Cotabato, Mindanao:		
Coleoptera	8	6
Orthoptera	3	2
Chilognatha	1	1
Arachnida	1	1
Vermes	1	1
J. J. Eaton, Manila:		
Lepidoptera	3	3
Orthoptera	4	3
Hemiptera	5	3
Thysanura	3	1
Coleoptera	7	3
Hymenoptera	2	2
Isoptera	15	1
Arachnida	2	2
Sr. Manuel Gaspar, Manila: <i>Bruchus fabæ</i> (in white beans)	180	
Sra. R. de Gaspar, Manila: Hemiptera Coccidæ (several specimens on rose).		
Juan De Guzman, Manila:		
Lepidoptera	16	12
Hemiptera Coccidæ	2	2
Coleoptera	9	1
Odonata	2	2
Heteroptera	59	1
Hymenoptera	1	1
A. R. Hager, Manila: Hemiptera	1	1
C. E. Kelbaugh, Manila: Lepidoptera (larvæ)	1	1
E. L. Munson, Cavite: Diptera, <i>Culex fatigans</i> (many specimens).		
Governor W. F. Pack, Sablaan, Benguet: Coleoptera, <i>Epicauta</i> (on potato)	28	
Miss Mary Polk, Manila: Lepidoptera	1	1
G. E. Sanford, Manila: Diptera	1	1
Dr. P. L. Sherman, Mindanao: Arachnida, Tarantula	1	1
P. L. Stangl, Manila:		
Lepidoptera	7	3
Orthoptera		
Hemiptera	180	6
Coleoptera	19	13



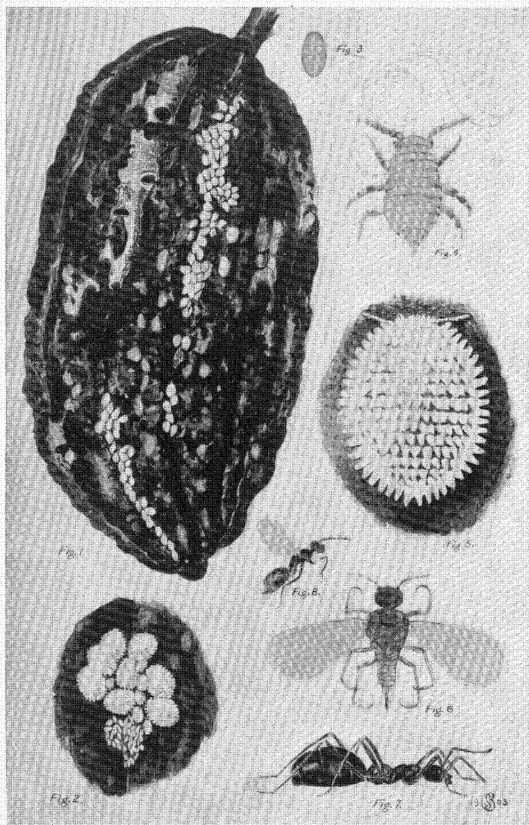


PLATE I.

Fig. 1. Cacao pod, showing mealy bug (natural size) and the attendant ants and sheds built by same; fig. 2, female mealy bug and young, slightly enlarged; fig. 3, egg about to hatch, very much enlarged; fig. 4, young insect just hatched, showing filamentous mouth parts; fig. 5, female mealy bug, very much enlarged; fig. 6, male mealy bug, very much enlarged; fig. 7, species of ant which attends mealy bugs, enlarged; fig. 8, hymenopterous parasite of mealy bug, greatly enlarged.

Drawn from nature by Charles S. Banks, 1903.

Insects received December 9, 1902, to August 27, 1903—Continued.

	Specimens.	Species.
P. L. Stangl, Manila—Continued.		
Hymenoptera.....	3	3
Scorpions.....	1	1
Chilognatha.....	1	1
Isoptera.....	Several.	1
Acarina.....	1	1
Wm. B. Wherry, Manila:		
Coleoptera, <i>Lasioderma serricorne</i> (in tobacco).....	3	.....
Diptera, <i>Stegomyia fasciata</i> (on clothing).....	7	.....
Diptera, Muscidae, all stages in culture media.....	.....	.....
F. H. Willyoung, Manila, Orthoptera.....	1	1
P. G. Woolley, Manila:		
Hymenoptera, Sphecidae.....	1	.....
Hemiptera.....	50	1
Lepidoptera.....	1	1

A PRELIMINARY REPORT ON INSECTS OF THE CACAO, PREPARED ESPECIALLY FOR THE BENEFIT OF FARMERS. BY CHARLES S. BANKS.

Up to the present time, so far as search has revealed, very little has been published upon the subject of economic entomology in the Philippine Islands. In the several admirable works on the entomology of the Archipelago we find not only that the economic side has been entirely neglected, but also that the same thing is true from the biologic standpoint. The only attempts made in the past have been to determine the names of specimens, in most cases collected by one man and classified by others. For even the most common species of insects few or no data are given regarding their habits, life, history, or relative abundance at certain periods of the year or in stated localities.

In preparing this brief preliminary report on the insects of the cacao I realize that I am but hinting at some of the more important pests that have been encountered during a comparatively short period of the year, so that all the conditions as they would occur consecutively during the course of twelve months, and undoubtedly changing slightly with each succeeding year, are not now noted, nor are all the subjects mentioned treated exhaustively, the object being at the present time only to set forth as clearly as possible some of the most common and more destructive insects, with practical suggestions for the prevention or treatment of their ravages. At the same time it is proposed to mention a few of those insects which, because of their predatory habits in feeding upon the injurious forms, should be considered as beneficial to the farmer.

Perhaps one of the most valuable crops produced in the Philippine Islands in proportion to the quantity raised is the cacao bean, the product of a tree of the family Sterculiaceae and botanically known as *Theobroma cacao*. The tree averages from 4 to 12 meters in height, and, as grown in these islands, usually assumes a somewhat oval form in its mode of branching, like the pear tree of the United States.

Like nearly all other plants, when brought into cultivation, it is subject to many diseases and the attacks of a large number of insects. This is more or less true in all parts of the world where it is grown—in Venezuela, Trinidad, Java, and particularly, it would seem, in the Philippines.

In this bulletin some of the injurious forms of insects will be mentioned, together with what has been learned of their life histories up to the present time.

As it is very necessary to know the most susceptible stage of an insect's life in order to know what is the most effective remedy to apply to it, we can readily see the necessity for becoming familiar with its life history.

It is hoped that further observations will enable the writer to treat the subject more exhaustively at a future time.

In suggesting remedies those are given which have been found most effectual for similar pests in the United States, but the effort has been made to so modify them as to make them fit local conditions.

For convenience, the subject has been divided according to the part of the plant attacked. Thus, beginning with the roots, we will, in order, discuss the insects of every part of the tree, giving their habits and mentioning the best means to be used against them.

INSECTS ATTACKING ROOTS.

The principal insects at present known to attack the roots are a species of large, black, stinging ant, a species of *Cicada*, and a grub of a beetle belonging to the genus *Anomala*, but not yet identified.

The ants are black and are characterized by the ability to inflict a very severe sting. The abdomen is constricted between the first and second segments, the first segment having two backward-pointing spines on the upper part. The head, thorax, and first and second abdominal segments are beautifully corrugated. The legs and antennæ or feelers are very long. The light-brown cocoons, made of a silk paper, are usually very abundant in the nests, which are located at the base of the tree among the larger roots. Within these cocoons may be found the white grubs, which are shaped very much like a long-necked gourd, the head being at the smaller end. (See fig. 146c.) The larvæ or grubs, before spinning their cocoon, and the eggs are simply deposited by the workers in any convenient part of the nest. The adults are the only injurious forms of these insects. They gnaw the bark from the large roots, thus inviting decay, and making an opening for the entrance of the insidious white ant, another very serious enemy of the cacao, belonging to the genus *Termes*. This insect is called *any* in Visayan and Tagalog, and is probably the most serious insect pest in the Philippines, destroying, as it does, nearly every conceivable class of material except articles made of metal. It has hitherto been supposed to attack only woods which had been previously cut, but in the work of investigation of cacao insects, it has been conclusively proven that they also attack the living tree, at least in the case of the cacao. (See fig. 147.)

In the United States the members of the genus *Cicada* are restricted to not more than five species. In the Philippines there are several, some being large and black and others gray, while still another species is of a very light yellowish green. A singular thing about the individuals of the genus is that the males give forth a strident noise, produced by means of two drum-like organs on the lower side of the first segment of the abdomen. Unlike the members of this genus in America and Europe, which generally "sing" in the hottest days of summer, the individuals found in the Philippines almost invariably reserve their serenade till the falling of darkness, when their strident notes may be heard on every hand, especially near wooded lands.

All observations thus far made upon this interesting insect would lead me to infer that the habits and life history are the same in the Philippine Islands as in other parts of the world, particularly as in the case of the dog-day cicada in the United States.

Here the species may be found at all times, and the insects are so common as to be used as playthings by the native children, who capture them to make them "sing." In Visayan they are called "ceriritan" and in Tagalog "culiclic."

The adult of the species which attacks the cacao tree measures 42 mm. to the tip of the wings, which project 13 mm. beyond the tip of the abdomen. The body is robust, somewhat conical, and is composed of a series of very regular segments, which may be more easily distinguished on the abdomen than on the thorax. (See fig. 148.) The insect has four very beautifully marked transparent wings, the fore ones being much larger than the hind. The venation is shown in fig. 149.

When at rest the insect's wings are laid over the abdomen, roof like. The cicada has a swift, but erratic flight. This is due to the lack of coordination between the wing muscles of the opposite sides of the body. By holding the insect between the thumb and the fore finger, so that the wings are free to move, it will be seen that the opposite pairs move alternately.

The insects of this genus pass through a very remarkable series of changes from the egg to the adult stage. The total duration of the metamorphosis has not yet been determined, but it is safe to estimate that in this region the time occupied is not less than eighteen months. In America, one species nearly related to this, lives from thirteen to seventeen years in the ground before reaching maturity, while another completes its transformation in two years.

The female cicada is provided with a very peculiar ovipositor or egg-laying apparatus (fig. 150), by means of which she slits the twigs of young branches of the cacao. Inasmuch as the wood of the cacao is comparatively soft, she finds no great difficulty in placing her eggs in branches which are larger than those ordinarily found with cicada eggs in the United States. Within from four to six weeks from the time the eggs are laid, the young hatch. They are tiny white creatures which resemble very much the full-grown nymph, except in size. Their forefeet are adapted for digging in the ground, and they, dropping from the twigs, begin immediately to burrow down to the tender rootlets of the plant, where they settle and insert their beaks for sucking the juices of the roots. Fig. 151a shows the nearly full-grown nymph and fig. 152 shows its forefoot. The larva or nymph forms a dirt cell around the spot where it decides to remain. This it does with its forefeet, using them as a mole would and packing the earth at the rear and above it with its other legs. Thus is made a subterranean cavity where this little enemy of the roots of the cacao may live and feed.



FIG. 147.

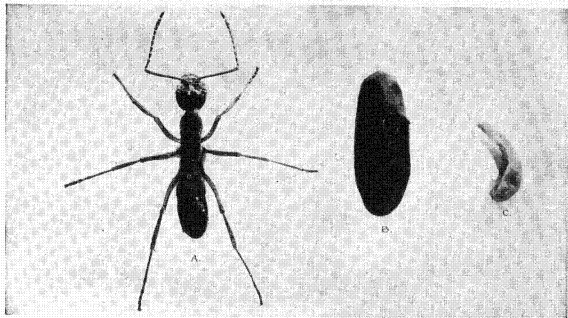


FIG. 146 C.

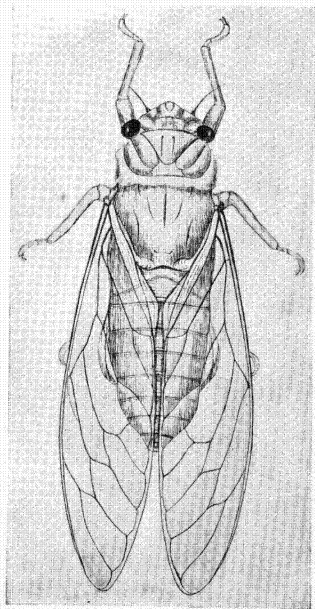


FIG. 148.

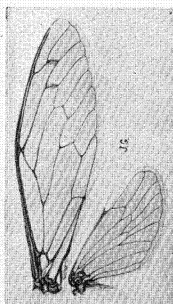
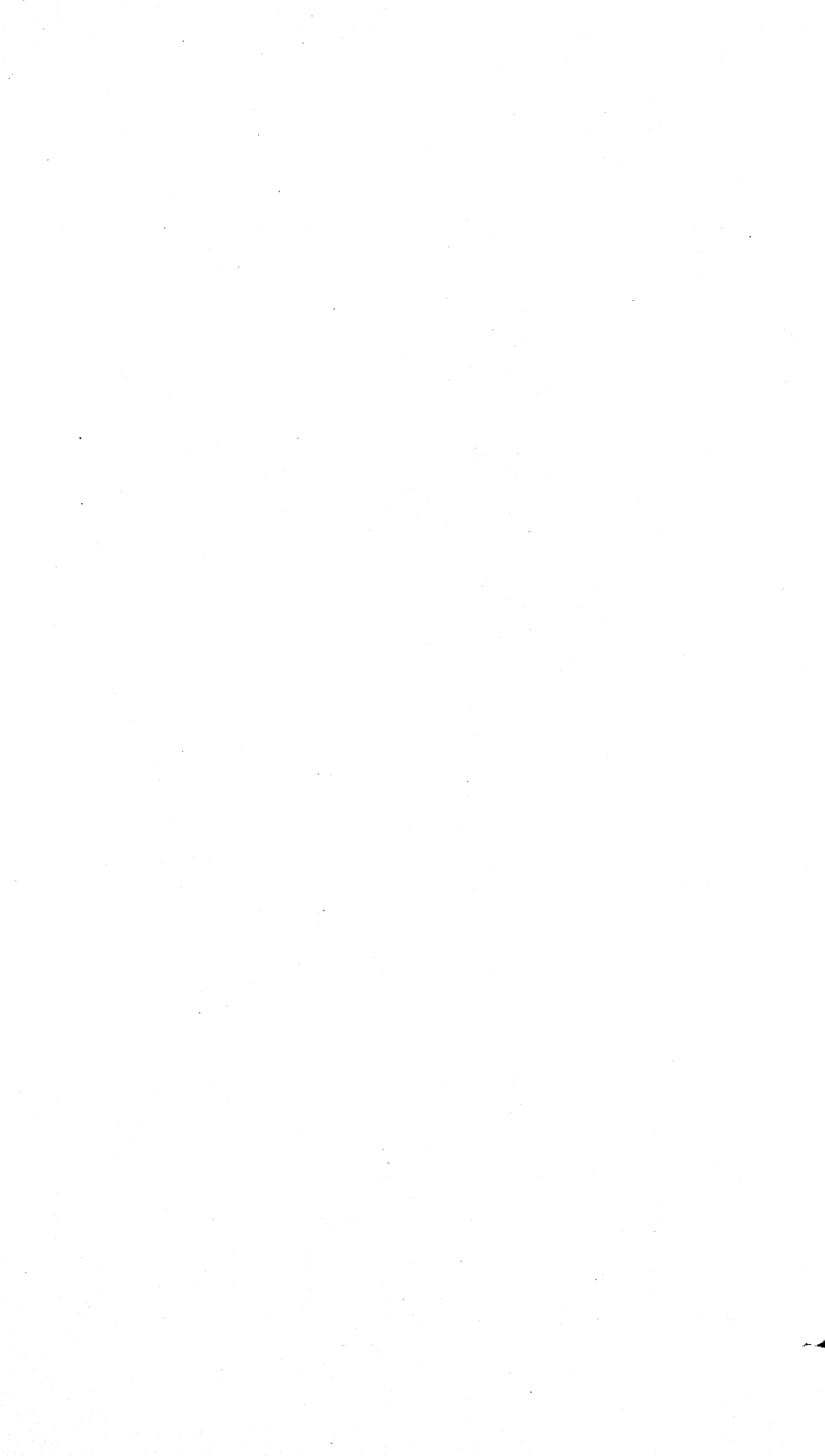


FIG. 149.



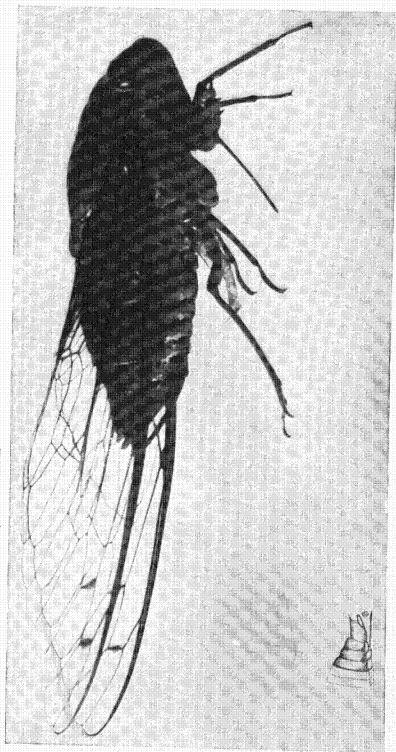


FIG. 150 (ORIGINAL).

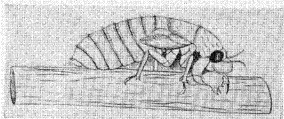


FIG. 151 (ORIGINAL).

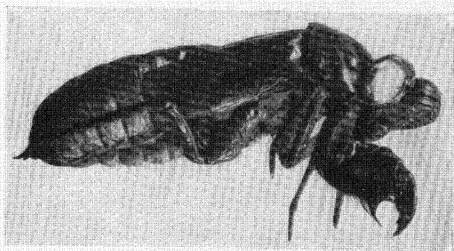


FIG. 151 a.



FIG. 152 (ORIGINAL).

The mouth of the insect is of the sucking class, that is, the various parts are modified to form a lancet for piercing the epidermis of the plant upon which it feeds, and a tube-like structure through which the sap is drawn up into the mouth cavity, whence it is conveyed to the stomach.

When very young the larvæ may be found not more than 10 or 12 cm. below the surface of the ground, but as they grow larger they gradually work their way downward. In some cacao trees they have been found as deep as 80 cm. below the surface, clinging tenaciously to the roots by their beaks and their legs. They are not at all able to defend themselves, nor to escape from any kind of enemy which might come upon them.

These insects do not change their form to a very marked degree in passing from the young larvæ to the pupa and the adult stages, as do butterflies, beetles, and flies. Just previous, however, to their assuming the adult form, there appear tiny wing pads on the sides, and within these are the wings in embryo. These pads appear in the second molt previous to the adult stage. (See fig. 151, which shows the wing pads lapping back upon the abdomen.)

When the insect is ready to assume its final or winged form it comes up out of the ground, leaving a tunnel behind, which may often be found when digging out trees. These tunnels are sometimes partitioned off and used as a nest by a certain species of small tarantula, which will be mentioned below.

Upon reaching the surface of the ground, the pupa of the cicada climbs to some convenient place, usually the trunk of the cacao tree or the small scions which spring up around the parent tree, and there it clings, awaiting the final change, which consists in the bursting of the pupal skin and the emerging of the adult insect. This takes place as follows: The skin of the pupa splits longitudinally on the back, from between the eyes to the posterior edge of the thorax. The insect within this shell begins a forward wriggling motion and soon the head is free from the casing. The forelegs, which in the larval and pupal stages are much shortened hooked claws, come forth from the pupal case, long, slender and fitted for walking instead of digging. The insect grasps some projecting point upon the bark where it is resting with these yet feeble claws, and thus is aided in his exit. The second pair of legs soon come forth; then the wings, which are doubled up very much and are very soft, are drawn out from the shell. At this stage the animal rests a while, apparently nearly exhausted. When it has thus rested the insect makes its final attempt and the hind legs are withdrawn. It now simply remains upon the tree, and the doubled and delicate wings begin to expand until they have reached the tip of the abdomen. This expansion continues till they have reached their full length. They are now very thin, of a beautiful translucence and very soft, so that the least breeze causes their fluttering. The body of the insect is also very soft and may be easily crushed. It is of a very pale, pinkish color, but soon turns gray (evidently owing to the action of the sunlight), all the characteristic markings coming out upon its surface. Within an hour, seldom less, the insect begins to move its wings as if testing them, and now the slightest movement on the part of the observer will cause it to quickly take wing, giving a short clicking sound as it flies away. If the insect be a male, it at once makes its characteristic "creet," a noise familiar to all, as it starts to fly. If it be a female, it remains in silence. It is not definitely known how long a period elapses from the emergence of the insect from the ground, until it mates and begins the work of laying its eggs. Further observations will be necessary to determine this.

The principal injury to the cacao from these insects consists in the lacerating of the young wood by the females in placing their eggs and in the damage done by the larvæ and pupæ to the tender rootlets. The former not only debilitates the tree from the mechanical injury, but also opens a path by which other injurious insects may enter the tree to do their damage. This is no inconsiderable feature of their harm, especially when they attack the larger twigs and stems, because it is more frequently upon the larger stems that *Scolytids*, *Cerambycids*, and other beetles do their work.

When 50 or more of the larvæ attack the young roots and rootlets, the principal food-getting organs of the tree, they not only use up the moisture which the roots have already taken up, but they likewise so mutilate and debilitate the latter as to impair the functions of moisture gathering. Of the several cacao trees which the writer dug up none were more than 5 m. high, and in no case did their roots extend more than 95 cm. below the ground surface, and as the pupæ of cicada were found as low as 80 cm. it can be readily seen that they command practically the whole of the root area.

In the matter of combating these insects several methods suggest themselves. As it is practically impossible in a large plantation to use preventive measures entirely, those means which also look to the extermination of the already established pests must be used.

The pupæ, when emerging from their ground retreats, are entirely helpless, and they, as well as the newly transformed adults, are easily captured upon the daily visits to all the trees by the watchman and workers in charge. This could very easily be done by children, who seem particularly expert in capturing the insects, which they like to make "sing." Even the full-fledged adults of several days may be captured upon the trees at dusk, when the males begin their concerts and the females are close by to listen. Occasionally during midday the insects may be caught upon the tree trunks, but are more wary and harder to capture.

Certain species of birds are known to be enemies of the cicada, at least in the island of Negros. Repeatedly, the writer, when in the cacao plantations, has heard the uneasy "creet" of the cicada, and following with his eye the direction of the sound, has seen a bird carrying of the insect. The species could not be ascertained, but from its general size and form it undoubtedly belonged to the shrikes or *Laniidae*. This should lead the grower to carefully protect all birds which have the inclination to visit or live in the plantations of cacao, as being beneficial, not only in the destruction of the cicadas, but also in ridding the trees of other injurious insects like scale insects, mealy bugs, and caterpillars of various species.

If the insects are captured upon emerging they will have no opportunity to lay their eggs, but as this can not be done in all cases, a close daily survey of the trees at the time when the cicadas are beginning to be numerous, will reveal the work which they do on the twigs. The characteristic appearance of the twigs after eggs have been deposited in them is shown in fig. 153. It was claimed a number of years ago that the cicada only deposits her eggs in dead twigs, but observation has since proven that this is not the case, she invariably choosing live wood for this purpose. The short time during which the eggs remain in the slit would not be sufficient for the growth to crush them, and moreover, the growth of a twig which has been lacerated by the ovipositor of the cicada is away from the wound, causing the latter to gape within a year from its laceration, as shown in fig. 154. If these twigs are carefully removed by means of a very sharp knife, and if they are afterwards destroyed by burning, while the eggs are yet unhatched, much can be done to lessen the number of cicadas attacking the trees.

If a twig into which eggs have been newly laid be examined by cutting it open longitudinally, the white eggs will be found arranged very regularly in the cavities which have been made to receive them. If the eggs have recently hatched, their transparent and shriveled shells will be all that can be found. After a few days these shells will have disappeared, being eaten by the numerous ants which constantly swarm on all parts of the tree. It may be that occasionally the eggs are found by the little red ants and eaten before they are hatched, but as the fibers of wood left by the boring of the female cicada pretty effectually close the cavities, this is not probable.

During the months from January to April, 1903, all sizes of larvæ and the pupæ were found when cacao trees were dug out. During this same period the adults were fairly abundant, as were the cast skins of the pupæ on the trees. It is therefore probable that the period of greater abundance of the adults is during the latter part of the year, probably in October and November.

The question of the killing of larvæ after they have once entered the ground is a most difficult and serious one. There are few substances which have sufficient penetrating power to enter the soil and be effectual against the larvæ without endangering the young roots of the trees. Probably one of the most useful of these is carbon bisulphide, an extremely volatile transparent liquid resembling highly refined petroleum, but having, when not pure, an extremely disagreeable odor. It is highly inflammable and heavier than the air, and therefore sinks readily into holes or crevices in the ground. Its extreme inflammability renders great precaution necessary when handling it. It must not be kept in houses where lights are used, nor must it be left in large quantities in bright sunlight, and the vessel used to contain it must be capable of being sealed. The fumes of this chemical, while not actively poisonous when breathed by human beings in limited quantities, are extremely disagreeable and are productive of headaches. If inhaled for a moderate length of time they suffocate. The substance should be handled only by those who are thoroughly acquainted beforehand with its properties, and then only by those who can be trusted to carry out instructions concerning its use. It should be kept where it can not be reached by children, and should be labeled "poison." Glass-stoppered bottles, or tin cans having best quality cork stoppers are the best receptacles for carbon bisulphide.

It is possible that gasoline or naphtha would in a measure serve the same purpose as carbon bisulphide, but no experiments have yet been made to verify this supposition. Neither of the liquids would have the advantage of cheapness over carbon bisulphide.

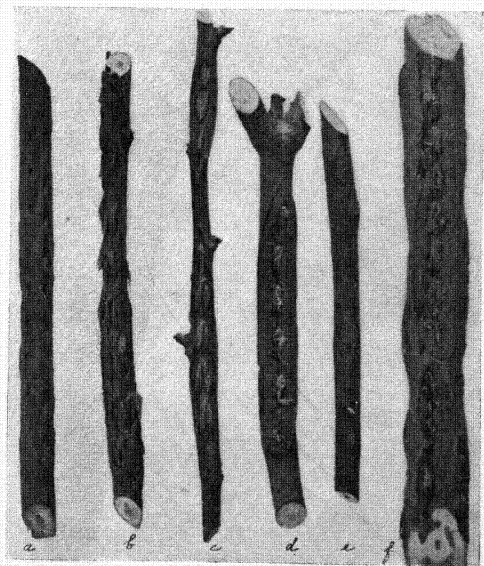


FIG. 153.

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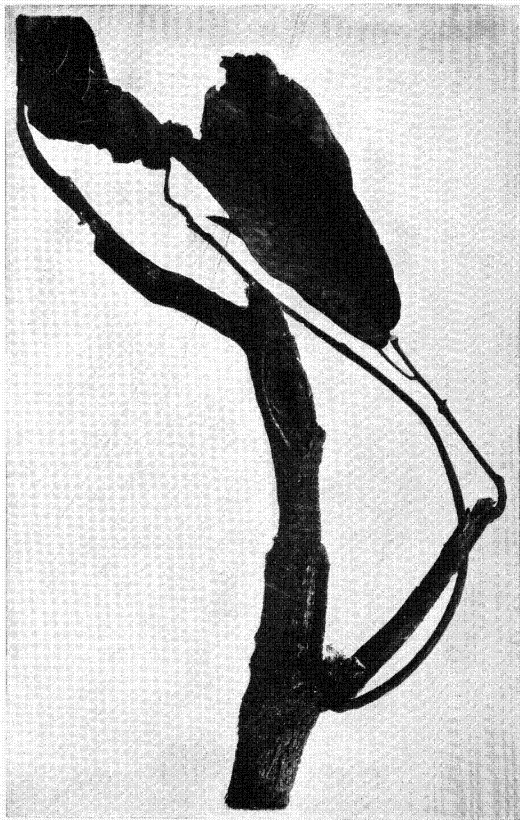


FIG. 154.





FIG. 155.

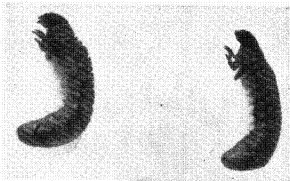


FIG. 156.

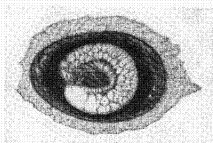


FIG. 157.

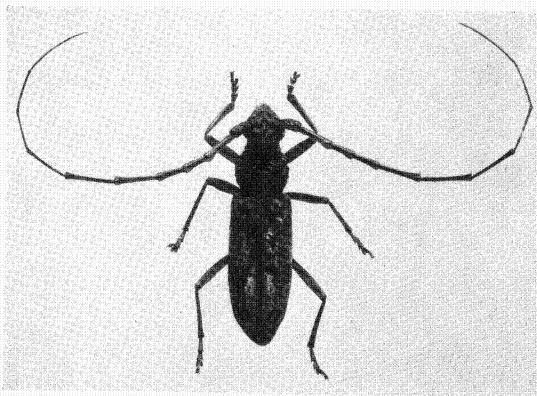


FIG. 158.

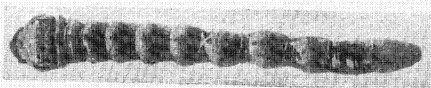
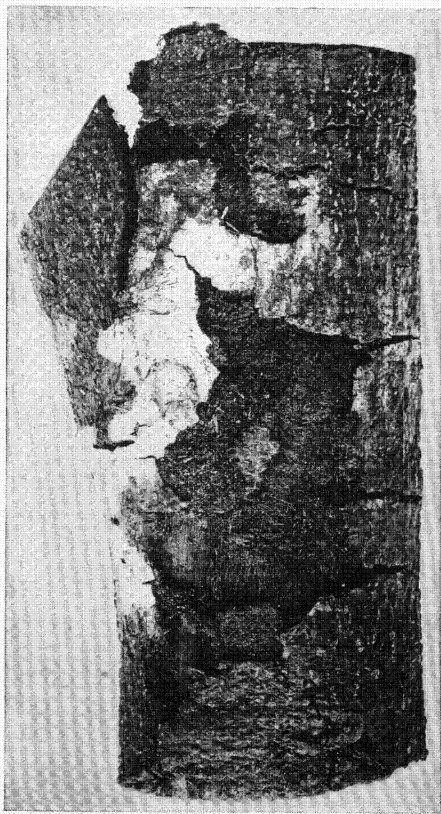


FIG. 159.



BLOTCH CAVITIES PRODUCED BY BORER, SHOWN AT FIG. 158.

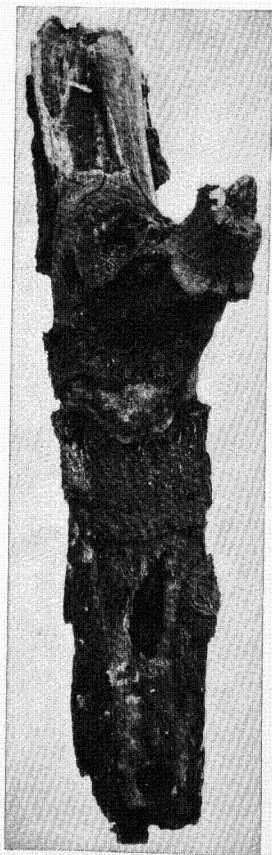


FIG. 160.

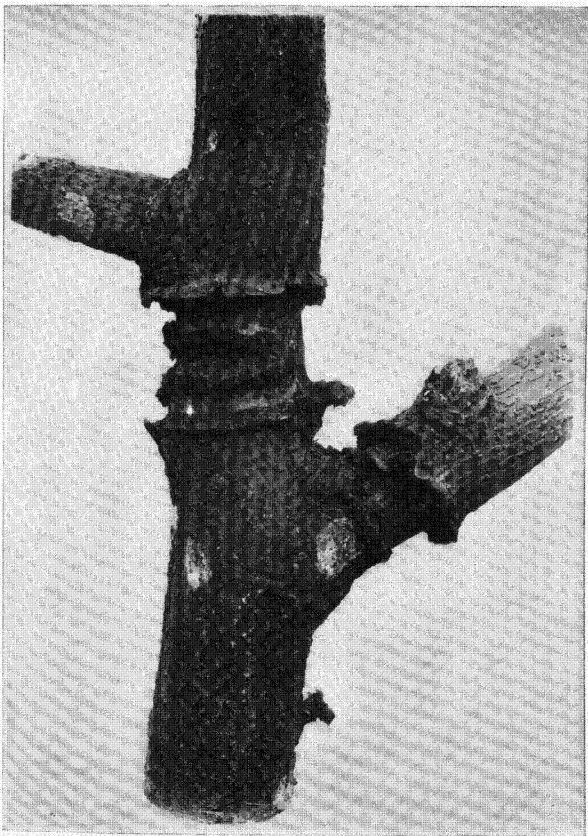


FIG. 151.



FIG. 162.

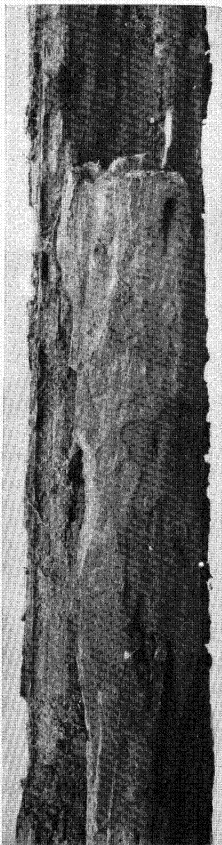


FIG. 163.



FIG. 163.

At present the price of this chemical in the Philippines is such that the general use of it as an insecticide is almost out of the question. In the United States, when bought in large quantities, it may be had for about 15 cents per pound. By the single pound it costs about 25 cents gold. In the drug stores of Manila it may be bought at 75 cents gold per pound, or 55 cents gold in quantities of from 50 to 100 pounds. It is hoped that with this, as with other important insecticides, some plan may be devised to enable the farmer here to procure them at a lower cost.

The most effective method for the application of bisulphide to trees for the killing of insects attacking the roots, and the one which is least dangerous to the tree, is as follows: The trees may be treated successively by one or several men. An instrument should be used by which a hole 50 or 60 cm. deep and 2 cm. in diameter may be bored into the earth, about half a meter from the crown of the tree. There should be three of these holes equidistant around each tree and into each should be poured not more than 25 c. c. of the carbon bisulphide. The hole, after introducing the liquid, should be immediately stopped up with wet earth or thick wet cloths, and left in this condition for several hours. The cloths can then be taken away or the ground raked or leveled if earth only has been used. These measures can be tried at any time, but preferably just after a period when a large number of twigs of the trees have been found lacerated by the female cicadas, as in all probability the eggs will have been but recently hatched and the larvæ therefore but a short distance below the ground.

When anay or ants are found working below the crown of the tree, similar measures for their extermination may be employed. A dampened canvas or other airtight cloth may be placed around the base of the tree, in the form of a conical tent with broad base. Under this tent, after earth has been packed around the base, a small quantity, from 15 to 20 c. c., of carbon bisulphide may be poured upon the ground within the tent, and the whole thus left for half an hour. If rightly applied, this remedy will kill all insects within the inclosed area without doing damage to the tree itself. The method here described applies only to trees which have attained their full growth and just after the bearing season. With smaller ones a proportionately smaller amount of the bisulphide should be used.

Not only will the method described for the killing of the larvæ and pupæ of *Cicada* prove effectual for these insects, but it will also be equally so against the white grubs so commonly found among the roots of the cacao tree.

These white grubs are the larvæ of one of the Lamellicorn beetles and probably belong to the genus *Anomala*, the adults of which have been found in cacao plantations in some abundance. In general, the habits of all beetles of this genus are the same. The adult of a very common species is shown by fig. 155, and the larvæ of the form found in the cacao roots in fig. 156. It is not known how or where the eggs are laid, but they are probably deposited in the débris which naturally collects around trees which are ill cared for. The larvæ, upon hatching, have but a very short distance to go, in the case of the cacao, before they find the young tender rootlets upon which they feed with avidity.

These larvæ can be very easily recognized. The form of the body is characteristic. When found they are invariably curled up, assuming this position as a means of defense. The full-grown larvæ measures 3 cm. in length and about 5 mm. in diameter. The long, rather slender, yellowish hairy legs are bent forward at the first joint. In crawling the insect uses them very awkwardly. The head is ochre yellow, shiny, and covered rather sparsely with stout bristle-like hairs. Examination with a strong hand lens reveals the fact that there are no eyes, at least none externally. The dark brown jaws or mandibles are well fitted by their form and position for cutting off bits of the roots upon which the animal feeds.

The body has a somewhat corrugated surface, and upon the back of each segment there is a transverse area covered with fine, brown, very short bristles, which aid the insect in burrowing into the ground. The rear four segments of the abdomen are somewhat broader than the others and are of a darker color, owing to the mass of excrement contained in the alimentary canal.

That these insects do much damage to cacao is evident from their abundance and the fact that they are related to species which are very injurious wherever found in other parts of the world. Living, as they do for the greater part of their lives, below the surface of the ground where cultivation of the plant will not disturb them, they form one of the hardest classes of insects to combat. The effects of their work are such as are not apparent until the weak and dying condition of the tree and its inability to bear fruit tell the grower that it is being killed by some unseen insect enemy.

The full-grown insect, a beetle, is shown in fig. 155. It measures from 9 to 12 mm. in length, is of a shiny greenish-brown color, and the wing covers are very much rounded. Fine striations, running longitudinally upon the wing covers, heighten

its sheen. The beetles are usually found upon the leaves or in crevices in the bark, where they appear always to be in hiding. These beetles are very peculiar in their habits, invariably simulating death when they are disturbed. They drop to the ground, where they lie perfectly motionless among the rubbish around the tree until the disturbance has passed. If care be used, a very slight jarring of the tree will cause them to drop to the ground, where, if there be no débris, they may be seen and killed. A word of caution, however, should be given as to jarring the trees. Perhaps no tree cultivated is so susceptible to ill treatment as the cacao. The fruit being so large and heavy may be shaken off by even a strong breeze, and it is therefore evident that jarring when the tree is in fruit will prove most disastrous to it. Only such trees as are just out of fruit, or in the blossom season, should be treated in this manner, and the jarring should be done with the palm of the hand, a gentle blow being delivered and only repeated two or three times for each tree. Anything more severe than this will result in disaster.

For killing the larvæ of the beetle above described the same methods as those employed for killing cicada larvæ may be used.

When this insect is ready to change to the pupa stage, it builds a cell composed of compacted earth. This is somewhat larger than the larva, and as the latter shrinks considerably just previous to the pupal stage, there is sufficient room for it to effect the final change to the adult, allowing for the proper expansion of the wings and wing covers. While in this pupal cell the insect appears as in fig. 157.

While birds, particularly crows, feed most readily upon all forms of white grubs when they are exposed in fields by plowing, it is very doubtful if they perform any appreciable service in the destruction of the *Anomala* beetle, unless it be that they pick it from the trees when it has reached the adult stage. Therefore all efforts against these pests will consist of the destruction of the larvæ at the time of application of remedies for the cicada and the jarring of the beetles from the trees, as described above.

Of all the cultivated plants observed in the Philippine Islands perhaps none has been found that suffers more from insect attacks on the trunk than the cacao. The insect which is of first importance is the flat borer of the cacao. It belongs to the family of long-horned borers, the *Cerambycidae*, an adult of which is shown in fig. 158. The damage done by this insect is much greater than that done by any other insect attacking cacao, inasmuch as it not only works for a long period unseen in the trunk, but finally effects the death of the tree, and the damage is hardly apparent to a casual observer until its deadly work is completed.

Ninety per cent of all trees examined in the island of Negros were found more or less completely damaged by this insect. The mode of attack and the results are so characteristic that when once described they will be noticed by the most careless observer, and will be always remembered as the work of this particular insect.

Going through a cacao plantation at certain periods in the year, especially in April and May, one will frequently notice at the bases or upon the trunks of the trees a kind of coarse fibrous sawdust. This may be of a light wood color or of a very dark mahogany red, if there has been a recent rain. One who is not acquainted with the facts might well suppose that this has been produced by the gnawing of some small animal like a rat, though upon closer examination it will be seen that the fibers are too regular to have been thus produced. If the bark be examined carefully, one will soon find a small hole of irregular form, about 1 cm. in diameter, from which there appears to be exuding more sawdust, usually of a dark color and wet, if recently pushed out of the burrow by the insect. If a hooked instrument or a knife be used to carefully remove the flakes of dead bark found around the hole, there will be found more of the same material underneath. If the search be continued, following the line of a now well-marked burrow, the chances are that at its end, whether just below the bark in the sapwood or within a deeper burrow toward the heart of the tree, a large yellowish grub with darker head and still darker brown jaws, will be found. The body is larger toward the head and somewhat flattened, giving the insect the name flat-headed borer. The body segments are well defined, as shown in fig. 159. The darker color of the hinder part of the body is due to the fact that the digested wood becomes colored by the juices in the alimentary canal of the larva. It would be well to state here that the fibrous masses of wood found in connection with this insect have not been used as food, but were simply cut away in the process of making the pupal cell and in filling up its entrance, in order that the grub may not be disturbed in its transformations to the pupal and adult stages.

This larva may well be described as a footless grub, one which is perfectly helpless when removed from its burrow, for when once taken out it is not only at the mercy of predacious insects like ants, but is of itself so helpless that it would soon die from lack of moisture before it could reach a place of safety.

The full-grown larva measures 40 mm. in length and about 4 mm. in diameter at the middle of the body. Its powerful jaws or mandibles enable it to feed readily upon the hardest parts of the wood in which it lives, and specimens have been found which have excavated tunnels 50 cm. long, in addition to the irregular blotch-like cavities which are formed just beneath the bark at the beginning of the attack.

The habits of this insect are very similar to related species in other countries, as the maple borer, *Plagionotus speciosus*; the sawyer, *Monohammus confusor*; the round-headed apple borer, *Saperda candida*; the oak pruner, *Elaphidion villosum*. The female lays her egg in a small puncture in the living bark of the tree and as soon as the young grub hatches it begins its work of tunneling the bark, the tender growing wood, and eventually the harder portions of the tree. Were it true that a single borer did its work in the trunk the damage done, though considerable, would not be so serious a menace to the life of the tree. But when several borers appear simultaneously in different parts of the trunk they soon succeed in girdling it, after which the tree is sure to die. Figs. 160, 161, and 162 show several large-sized branches killed in this manner. The grubs having destroyed one side of the tree, the latter puts forth its strength in efforts to heal up the wound, causing an abnormal growth to bulge over the bare space left by the insect attack. The wood and bark increase in thickness on the opposite side. Other grubs attack this part, which is particularly rich in food material, and thus by these successive attacks the living parts are all destroyed and the tree girdled.

Trees have frequently been observed in which, on a branch from 4 to 7 cm. in diameter, there would be a strip of only 1.5 mm. of living wood, and yet this branch would be giving forth leaves above the wound. Of course the latter were small, being ill-nourished, and no fruit could be expected upon such a branch. This illustrates the remarkable vitality of the cacao, and probably explains, too, its extreme susceptibility to injuries of any kind.

An interesting feature of the work of the flat-headed borers is the manner in which the excrement is packed behind it in the burrow, sometimes so solidly as to simulate the wood itself. It can, however, always be distinguished by its granular appearance as distinct from the fibrous structure of the wood. These filled burrows are frequently encountered in timber when it is sawed for building and other purposes. Wood having this appearance is called "wormy." A characteristic burrow of one of these larvæ is shown in figure 163, with also some of the frass as left behind.

When the grub is about to pupate it burrows toward the heart of the tree and upward, thus forming an oblique canal which when a short way in is changed to a vertical direction and is thus parallel with the wood fiber. Into this burrow the insect retires and changes its position so that the head is toward the opening. Within a very short time after the larva has entered this retreat and has packed in the fibers to close up its doorway, it sheds its skin as a grub and assumes a form which, upon closer examination, shows that it possesses characteristics of a beetle. The legs, antennæ, wings, and wing covers may all be readily distinguished if a careful examination be made. Unfortunately there have not yet been sufficient observations upon this insect to enable me to state the length of time during which it remains in the larval and pupal stage. On the 11th of March, 1903, a full-grown beetle was taken from a tree near one in which larval pupal forms had been found at an earlier date of the same year. This would seem to indicate that the period for the pupa is from four to six weeks, possibly not so long.

The adult, after its outer covering has become thoroughly dry and hard, subsequent to its change from the pupa, begins the work of gnawing away the material which as a larva it had packed in the mouth of its burrow, and it comes forth a very beautiful creature, entirely unlike the uncomely grub which had been doing the damage. Its length is 25.5 mm., its greatest breadth 6.5 mm. The antennæ in the specimen before me, measure 44 mm. When the insect is at rest, the antennæ are carried back over the body, projecting beyond the tip of the abdomen. The antenna has 11 joints, the second from the head being much thicker than the others and having transverse corrugations on lines upon its upper surface. Each succeeding joint, except the three last, is knobbed at its extremity and bears a spine on the hinder edge. The eyes, which are black and composed of what appear to be a number of fine jet beads, are crescent shaped, and are placed around the hinder edge of the sockets of the antennæ. The thorax is very markedly corrugated transversely and is covered with fine, golden-brown hairs, which give it and the wing covers, which are similarly marked, the appearance of a beautiful brocade velvet. The legs are rather long and slender. They are covered with fine hairs, as is true also of the under surface of the body. The feet are provided with a pair of hooked claws, which aid the insect in clinging to the bark. In the act of egg laying the female grasps the bark firmly with all her feet, and is thereby enabled to insert the ovipositor into the bark.

The beetles of this family make a peculiar noise when disturbed or captured. It is similar to the sound produced by rubbing the finger nail over a very fine file, and is made by the friction of the tip of the wing covers on the surface of the abdomen.

The question of combatting this insect is a very serious one, as the methods employed must at once be easy of application and likewise effectual at the time when the insect is likely to begin its greatest damage. The beetle almost invariably rests upon the bark, which is so nearly its own color as to make it very difficult to detect. It is therefore evident that any attempts to thus discover it and rid the trees of this pest by hand picking would prove practically useless. In order, therefore, that the insect be repelled from the bark, something must be used which will prove at once distasteful to it and harmless to the tree. Probably the very best method with young trees, when recently set and until they reach an age when the bark will not be susceptible to the effects of any strong wash which may be applied, is the complete enveloping of the trunk of the tree by means of cage protectors made of a coarse grade of abacá or "sinamay," such as is used in the Visayas for mosquito netting, and which has a net sufficiently fine to prevent the entering of the adult for egg laying. This material is so cheap that it could be used constantly, even until the trees have attained a considerable size. The bags are made of a cylindrical form, open at both ends, and having a draw string in one end. They may be slipped over small plants and the lower ends held close to the ground, either by embedding in earth or by the placing of a stone upon the lower edge. In the case of larger trees, where it is impracticable to slip this bag over all the branches, it is well to simply use a straight piece of cloth, putting it around the tree, and after doubling the edges together in the form of a hem they may be either sewed with coarse stitches or pinned by means of sticks of bamboo made in the form of toothpicks. Figure 164 is an illustration of a bag which was used for the protection of the upper parts of the trunk in order that during investigations the adults which emerged from the tree might not escape. In figure 165 a tree is shown protected by one of these bags. If opened at the bottom and held close to the ground by stones or earth this would serve admirably for keeping off the beetles. Wire screening would serve equally as well were it not for the fact that the extreme dampness would cause it to rust and thus quickly become useless. In the United States a heavy grade of tarred or roofing paper serves the same purpose, but its cost would be against its general use in the Philippines.

Where it is not practicable to use the method described above, some repellant to the insects should be applied to those parts of the trunk which are most likely to be affected. Inasmuch as these repellants are simply supposed to keep the adult insect from laying her eggs, it is very obvious that they should be applied before any insect has had a chance to deposit its eggs in the tree trunk. If the grub has once entered the bark, no application of remedies externally will have the least effect upon it, and other means must be taken. These will be spoken of later. Any strong-smelling substance, such as fish oil, tar, or pitch, which will adhere to the tree, or pure crude petroleum would prove effectual, but perhaps the best and most easily applied material for warding off the attacks of this borer is what is known as the soap and carbolic acid wash. This is prepared by dissolving 4 liters of soft soap in 4 liters of hot water and adding one-half liter of crude carbolic acid. This mixture should stand for at least twenty-four hours, or until it has become perfectly dissolved. Into this should be poured from 32 to 40 liters of rain water, and the whole carefully stirred until thoroughly uniform. It may then be used with a broad paint brush or swab on the end of a stick, covering all the parts of the trunk and branches which might be supposed to offer a place for the borer to lay its eggs. No fear need be had that this mixture will injure the trees if properly prepared in the proportions given. The period from the 1st of April to the 1st of June would be the best in which to apply this preventive, as it is during this time that the beetles come forth and are ready to lay their eggs.

An excellent preventive which has been used most successfully against the peach borers in the United States, and which would probably prove of value equal to that of the carbolic wash, is a preparation composed of lime, coal tar, and whale oil soap. This mixture may be put on in a comparatively thin coating, as ordinary rains do not easily wash it from the trees. It must be thoroughly applied to all parts of the tree likely to be attacked by the borers.

Tobacco dust has been advocated by some fruit growers in America as a preventive of the borers. The author leaves this matter until more thorough experimentation in the Philippines shall determine the advisability of recommending it for general use. If it be found an effectual remedy, there would be a decided advantage in employing it in lieu of insecticides which would have to be brought from abroad.

An effective measure to be used against the grubs which have already entered the tree is to carefully search for evidence of their existence beneath the bark, and when

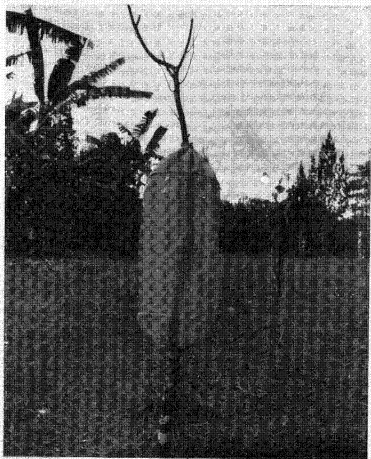


FIG. 164.



FIG. 165.

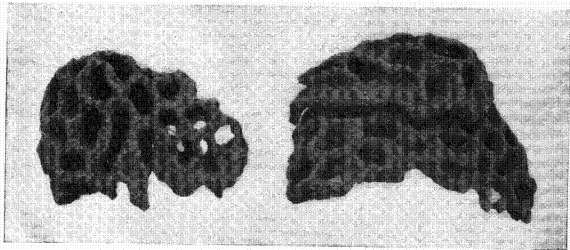


FIG. 168 *a*.

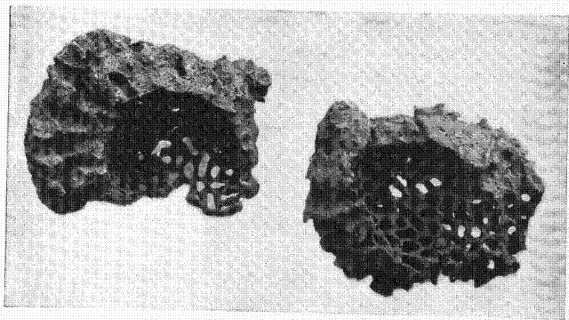


FIG. 168 *b*.

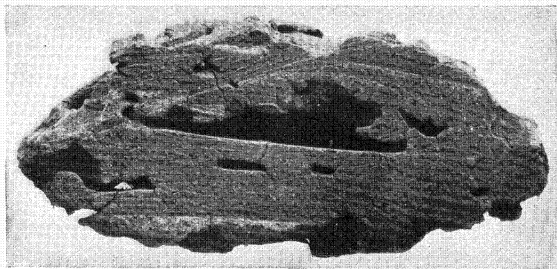


FIG. 169.



FIG. 171 *a*.

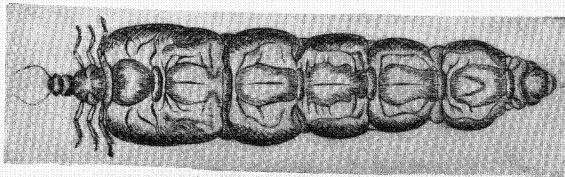


FIG. 166 (ORIGINAL).

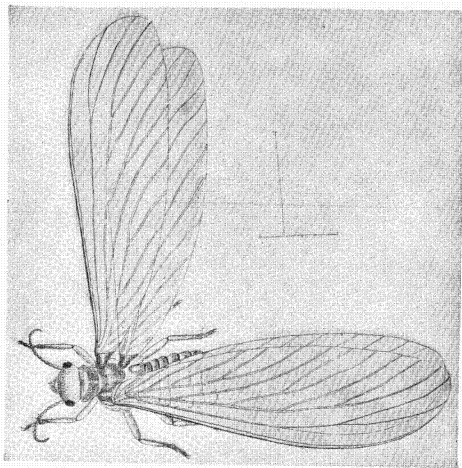


FIG. 167 (LINE SHOWS NATURAL SIZE).



INSECTS SHOWN IN FIG. 170, SOMEWHAT ENLARGED.



FIG. 170.

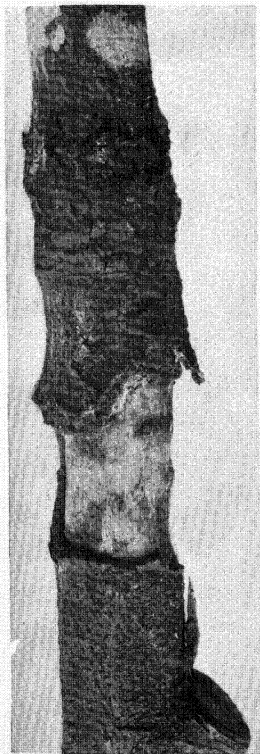


FIG. 171 (ENLARGED).



FIG. 172 (ENLARGED).

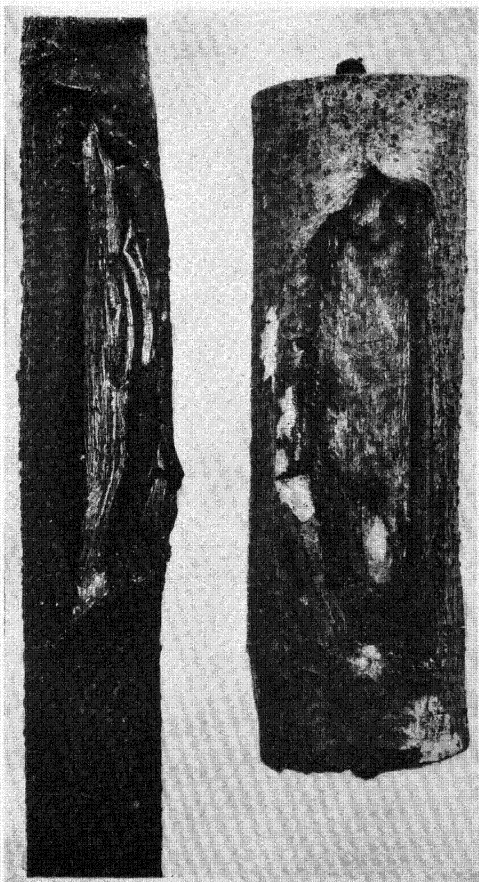


FIG. 172.

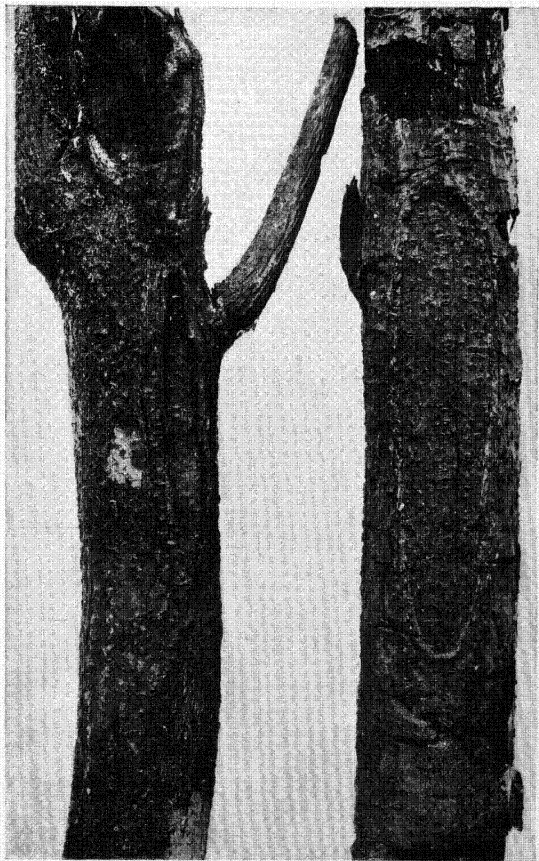
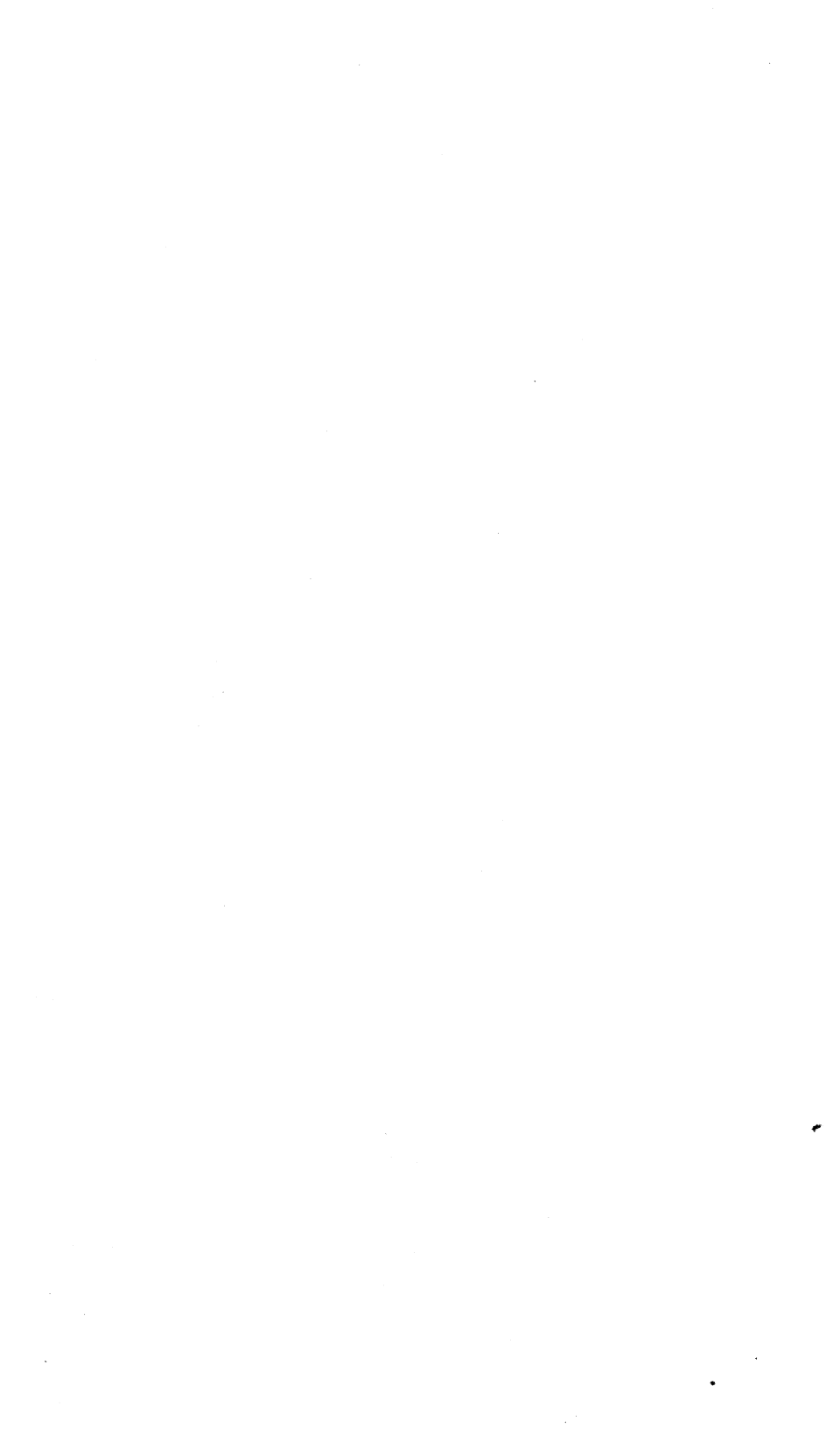


FIG. 172.



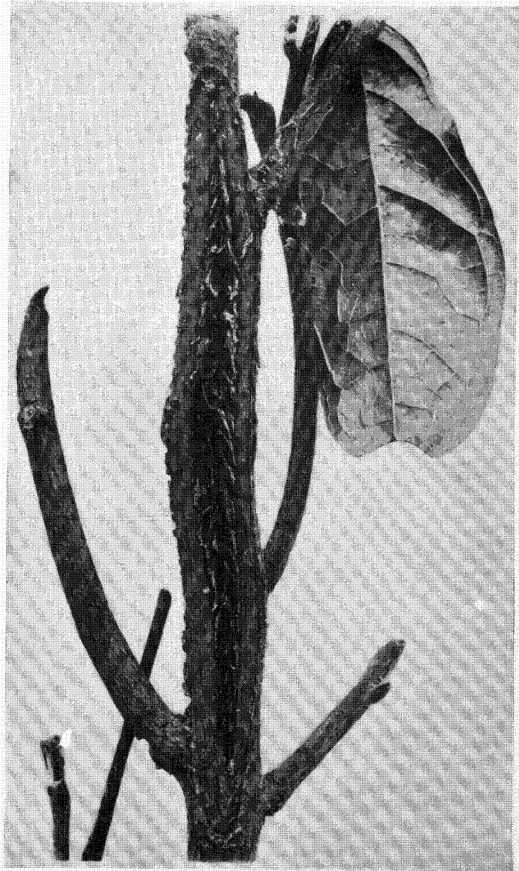


FIG. 173.

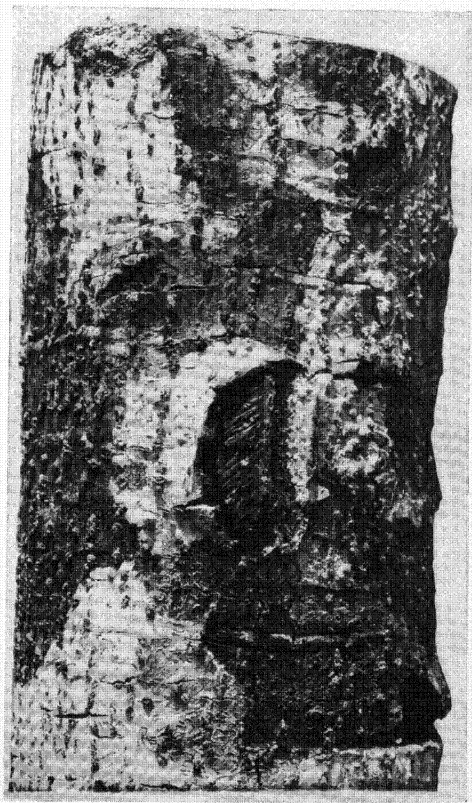


FIG. 174.

they are located to thrust in a stout piece of bent wire, with which they can be crushed. It is not necessary to extract the crushed insect, as when so injured it can not transform further, and there will be no danger of its coming forth as a beetle.

The fact must be constantly borne in mind by those who would grow cacao successfully in these islands that vigilance, not only over those charged with the work of caring for the trees, but also personal inspection of the orchards themselves by the owners will be necessary to detect not only the presence of these insects, but also a large number of other forms whose insidious working in places in which it is not easy to get at them renders them all the more pernicious. As in a clean house or in a clean city, diseases are less liable to enter and play havoc, so in a clean cacao orchard insects find less favorable fields for their ravages. This means that thorough and scientific pruning, careful cultivation as set forth in Lyons's bulletin on Cacao Culture,^a and a constant care must be taken against insect and other pests. Clean ground around the cacao trees proves less inviting to all kinds of insects which would be liable to lurk in the rubbish and dead leaves which often litter the plantations so far observed.

Another insect which has proven seriously destructive to the trunks of cacao trees is the "white ant," or termite. This insect, described as being destructive to the roots, does not by any means confine itself to these parts of the tree. (Fig. 147 shows the work done in the living trunk of a cacao which had first been seriously injured by the borer.) When once the white ant becomes abundant in a tree its life is practically over, unless the measures suggested be followed before the insects have extended high into the tree. These termites have an underground cell in which the queen mother of the colony is confined. Owing to her great size she can not leave this cell, and performs no other function save the laying of eggs, with which her enormous body is distended. (Fig. 166 shows a female, natural size, of a species closely related to the one which damages cacao trees. Fig. 167 shows the same kind of insect before her body has become distended with eggs.) Unless this queen mother be destroyed in some way the colony will go on multiplying indefinitely, it matters not how many of the ants found in the tree be destroyed. There are always thousands of workers in the ground chambers of the nest to attend to the rearing of the enormous brood. (Fig. 168 shows the cells where the young anyway are reared.)

In order to find out approximately the number of eggs laid by a female, a complete queen cell in which the queen mother was confined was dug out. (Fig. 169 shows the appearance of a cross section of this cell.) The female was carefully watched for several hours and was seen to be continuously laying eggs. These eggs were carried away in tiny adherent masses by the workers. A careful watch was made for one minute, and instead of allowing the workers to remove the eggs during this period the mass was carefully picked up with a fine forceps as fast as it had assumed the size of those previously carried away by the workers. A count revealed the fact that during one minute 165 eggs had been laid by the queen mother. No estimate of the weight of this mass was made, but it is safe to say that it represented not more than $\frac{1}{1000}$ of that of the female when fully distended. Some idea can be gained from this of the wonderfully prolific character of the termite and the futility of attempting to destroy a colony without first killing the queen mother.

The same species of large black ants which were mentioned as attacking the tree below the crown and among the roots will likewise be found in the trunk, especially after the attacks of the borer and the termite or any. They do not attack the trunk very high up, seeming to prefer living half beneath the ground. The same treatment recommended for this insect when found among the roots will apply to it when found in the trunk of the tree.

A little insect which is often rather abundant upon the trunks of cacao trees is a species of *Psocidæ*. This is perfectly harmless, feeding only upon the lichen growths which are to be met with. It should not be confused with the winged forms of plant lice, which are very injurious. This species of *Psocus* is red and black; the body being red and the wings mottled and of a smoky color. They are often found bunched together in considerable numbers on the lower trunk near the ground, and when disturbed scurry to one side like a flock of sheep, leaving a bare spot where the disturbing influence touched them. Among these aggregations the larvæ, which are wingless, the pupæ, which have tiny wing pads, and the adults, which have fully developed wings, may be found. (Fig. 170 shows a portion of a cacao tree trunk covered with these insects.) Since they feed upon substances entirely foreign to the life of the tree and simply use the latter as a place of abode, they may be classified as harmless.

^a See Bul. 2, Phil. Bureau of Agr., 1902.

Many insects, like caterpillars, will be found resting upon the trunks of cacao trees during the day, while at night they will be found feeding upon the leaves. These are often so nearly of the same color as the bark that they escape all except an eye trained to look for such things. One particular species of caterpillar belonging to the family Lymantriidae is so nearly like the caterpillar of *Porthetria* (*Ocneria*) *dispar*, the gypsy moth, as to indicate a very close relationship between the two, but as I have not yet succeeded in rearing the adult, the insect has not been determined. The habit of placing the cocoon or nearly naked brown chrysalis in the twigs and in holes in the bark is almost identical with that of *Porthetria*.

The caterpillar will be described when the insects which injure the leaves are discussed. Three very serious insect pests which attack the small branches and twigs, girdling the bark of the latter at their juncture with the stem, have been found in the larval stage, but all attempts at rearing or finding the adults have so far proven failures. (Fig. 171 will show how thoroughly the larva of one has done its work of girdling a twig which was 26 mm. in diameter. Fig. 171a shows a twig 13 mm. thick, which is also completely girdled by the insect.)

A peculiar and interesting habit of the larva, which first attacks the twigs to girdle them, is that of using its excrement, together with silk, for covering up the burrow or retreat in which it lives. This is very neatly done by fastening the particles together with a kind of silk and these pellets or particles of frass are so nearly the color of the bark from which the animal has obtained its food that the difference between this and the sound bark is often not noticed except after closest observation. This larva is of a dull grayish color with a brownish head. Its body is sparsely covered with stiff bristles and its general habits are similar to those of the Tortricidae.

The second larva is undoubtedly a Cerambycid, but as has been said, it has only been found in this stage and can therefore not be identified at present.

The destructive work of *Cicada* has already been mentioned in reference to insects which affect the roots of the cacao, and its habit of laying its eggs in the twigs make it likewise one of the insects injurious to the twigs and branches. The mode of treating twigs thus affected would be to cut off and burn all twigs in which the cicada eggs have been laid; one will frequently come upon a twig or even a good-sized branch which bears a peculiar scar like that shown in fig. 172. If a careful examination be made, this will be seen to contain shriveled eggshells about 4 mm. in length. Twigs will be found like that represented in fig. 173, in which the eggs show very plainly. The adult which lays these eggs has not yet been found, but from the general appearance of them, it is very likely that the insect is an Orthopteron; that is, belonging to the order of grasshoppers, crickets, etc., and may be one of the katydids, some very large species of which have already been taken in cacao groves. *Microcentrum retinervis*, the angular-winged katydid of the southern United States, lays its eggs, which are of about the same size as those shown in fig. 174, upon the edges of leaves and upon the stems of the trees which it inhabits, and therefore it may reasonably be supposed that the destructive insect in the case of cacao is a related species.

With many insects of this and other species affecting the cacao, long periods of observation and the collection of more material will be necessary in order to become thoroughly acquainted with their entire life history. In many instances thus far only one stage, or the work of the insect doing the damage, has been obtained.

One of the most serious pests of the leaves, tender buds, and flowers is a species of black plant louse. This insect attacks the young buds even before the leaves or the flowers have opened. The tiny eggs are laid in the folds of the buds and the bud scales, beneath the stipules of the leaves and in the crevices of the unopened sepals of the flowers. They are so minute that they can only be seen with the aid of a magnifying glass. As soon as the young hatch, they pierce the skin of the twig upon which they rest and begin sucking the plant juices. Some broods of plant lice give birth to living young, which in turn lay eggs. This question of the alternation of the mode of reproduction is very interesting to the student of biology, but has little value economically, at least in this latitude. The young plant lice resemble the adults in form. They are, of course, much smaller, and have no wings, but as certain forms of the adults are also wingless this feature alone will not aid in distinguishing the stages.

Plant lice are provided with a pair of spine-like projections which are like little tubes on the back of the abdomen, and which secrete a waxy substance much sought by ants. This substance is commonly known as "honeydew." Its nature is not clearly known. Wherever there is a colony of plant lice the surface upon which they rest will very often be found to be sticky and glistening, as though covered with sirup. This is the "honeydew" secreted by the plant lice. It is for the purpose of collecting this that ants invariably attend a colony of plant lice, caring for them assiduously in return for the "honey" which they secure. They frequently carry

the plant lice from place to place when the leaves or twigs upon which the latter have been feeding become dry and hard.

Even though only a single plant louse be found upon a leaf or flower, it is almost invariably attended by an ant and sometimes by two or more. Thus cared for, it is little wonder that the plant lice multiply and flourish to a remarkable extent. (Fig. 175 represents the different stages of the plant louse. It will be noticed that at *b* the pupæ are distinguished by the tiny wing pads which contain the wings.) These insects feed in all stages from the larva to the adult, and therefore their damage is considerably greater in proportion than that done by insects which feed only in the larval stages, like Lepidoptera, Diptera, and Coleoptera. Their minuteness appears to be fully compensated for by their numbers, and so the cacao grower has to be ever vigilant in order that he may successfully combat them.

The immediate effect of the attacks of the plant lice is to cause a drooping or wilting of the leaves, flowers, or flower stems which they attack. This is followed by a distortion of the part, the leaves curling toward the under side, where the plant lice are usually found. This shriveling is very marked upon some trees, and when the leaves have attained their full growth they will be found to be undersized and broken because of their efforts to outgrow the attack. Flowers, when attacked by the plant lice, shrivel and die without producing fruit. Occasionally the plant lice are found upon the very young fruits, the skin of which is almost as tender as the young leaves. Invariably fruits thus attacked either die from exhaustion, or if they survive, are very much distorted, presenting, instead of the regular, even lobed appearance of the perfect pod, a scarred, smooth side which has no semblance of the characteristic ridges. In this way the pods are formed in which the tip, instead of being straight, is twisted by arrested growth on one side and by the normal development on the other. (Fig. 176 shows a fruit thus distorted and also a perfect fruit.)

When the fruit pods have attained the size of a hen's egg, they are not subject to the attacks of the plant lice, and thus it will be evident that any remedy should be applied before this period.

As a means of treating plant lice upon the flowers and leaves of cacao, there is no better material than kerosene emulsion. There are several ways of making and applying this insecticide, but the best preparation for this purpose will be the kerosene and soap emulsion. This, if properly prepared and applied according to directions, will be found to be harmless to the most delicate parts of the plant. For its preparation see the chapter on insecticides.

In applying the kerosene emulsion some kind of spray pump should be used to facilitate the uniform distribution of the spray and to enable the workman to reach the higher branches of the tree with the emulsion.

Another enemy of the young cacao leaves which is likely to prove of considerable importance is the black thrips. This minute insect may escape even a close observer if he does not know the signs which indicate its presence. As in the case of the plant lice, the injury caused by the thrips makes the leaves curl up, as shown in fig. 177, but not as markedly as with the former. If one carefully examine a few leaves which show evidences of curlings, he will find upon the underside a number of very slender black and red objects moving very slowly from place to place. The black ones are the adults, the red ones the young thrips. The rear part of the abdomen is decidedly pointed, and the thorax bears a spine on each side. These insects are provided with sucking mouth parts, and cause an injury to the leaf similar to that caused by the plant lice. They may be combated by the same means employed to destroy the latter, and large numbers of them will be killed when the trees are sprayed for the Aphids. (An adult thrips is represented, much enlarged, in fig. 178.)

Another insect which, while not occurring in great abundance at the time when observations were made, is likely to prove a pest to the cacao, is the large yellow scale represented, magnified, in fig. 179. Its egg is shown at *b*. The adult female measures 17.5 mm. long, 13 mm. wide, and 9 mm. high. It is of a light salmon yellow color and is covered with a fine powdery substance. Beneath the scale secretes a white pubescence which is fibrous in structure. The upper surface is corrugated; the hinder part of the body is much higher than the forepart, and when at rest upon the twig or leaf the black legs and antennæ are completely hidden by the shell-shaped body. The forward part of the body is slightly notched. When the animal is disturbed and moves from place to place, the tiny black antennæ and tips of the black feet may be seen protruding from beneath the body. In February and early March these insects will always be found with the space beneath the dome of the body completely filled with tiny orange yellow eggs, which are 1 mm. long and 0.6 mm. wide. It is not yet known when the young hatch nor has anything definite been ascertained concerning the full life history of this insect. Further studies will elucidate points concerning this and other scale-like insects of the cacao.

The same method employed in ridding the trees of the Aphids will apply to the combating of the large yellow scale. Its soft body will make it peculiarly susceptible to the effects of kerosene emulsion.

Very frequently there will be met in the cracks and crevices under the dead bark and in holes where limbs have been broken off from the cacao a beautiful, iridescent, blackish-green or blackish-purple beetle, with very convex wing covers and antennæ which have the appearance of a string of beads. This beetle belongs to the family Sphindidae, a class of beetles whose larvæ feed upon dry fungi and decaying vegetable matter, and which are not injurious to the tree. When disturbed these beetles readily simulate death, and will drop to the ground until the disturbance has passed. They have been found in fair abundance in all cacao plantations.

The beetle measures 14 mm. in length and 5.5 mm. in width, the wing covers being 9 mm. long. The wing covers are marked by a series of nine longitudinal lines, which are punctuated by fine dots. The under surface of the body is of the same color as the upper (see fig. 180).

Occasionally there may be found upon the under surface of the beetle tiny light-brown roundish mites, which are parasites. This is a thing which is very common to many Coleoptera, especially those living in dark or obscure places.

Associated with the beetle may be found several species of cockroaches, some very pale yellow and about 15 mm. long, others mottled buff color, 20 to 25 mm. long, and still others which are about 35 mm. long and of a reddish-brown color. None of these do damage to the trees, as they live upon the decaying matter found in the crevices and wounds.

Other harmless forms pertaining to Thysaura, Coleoptera, Corrodentia, and Orthoptera have been met with upon the trees, but a description of these minor insects and of their life histories and habits will be left for a later report. In any attempt at treating the trees for injurious insects many of these will inevitably be killed.

The two principal destructive insects found upon the leaves are a species of caterpillar of the family Lymantriidae, and another of the family Eucleidæ. The caterpillar of the former can be easily recognized by its size and its hairy appearance. When full grown, and ready to transform, it measures 33 mm. in length and 10 mm. wide, without the hairs, which add 12 mm. to these dimensions all around, making the entire caterpillar occupy a space of 53 mm. by 30 mm. on the surface of the leaf. The adult and the egg-laying habits of this insect are not yet known, but it is probable that the female lays her eggs in patches upon the twigs, covering them with soft down from the outside of her own body, like a closely related species found upon the Ylang-ylang and the Talisay trees. These caterpillars, as has been stated, have the habit of feeding at night and resting upon the branches and the trunk of the tree during the day. When disturbed they raise the head and twitch the forepart of the body from side to side. If the disturbance be continued, they drop either to the ground or to a lower limb. The color is a dull gray, with a few reddish markings. The head is very large, grayish, and marked by darker patches of small dots. The hairs, which project forward from the neck, give the insect the appearance of wearing a ruff. When at rest upon the bark, the false legs of the abdomen, ten in number, are spread out beyond the sides of the body, firmly grasping the surface upon which the insect is resting. When the caterpillar is about to change its skin, or moult, a process which it perform five times before changing to the chrysalis, the six true feet are drawn up together, the head is drawn down toward the legs, and the fore end of the body is elevated. This insect, before pupating, finds a convenient place at the fork of a small twig, or in a crevice in the bark, and there it spins a very poor apology for a cocoon. The cocoon looks more like a wide-meshed basket than a true cocoon, and doubtless serves simply to keep the large brown chrysalis from falling to the ground. Unfortunately several of these chrysalids, which were put into a box for rearing, transformed to the adult stage in transit to Manila from the place of capture, and were so badly damaged as to be unrecognizable when the box was opened.

In addition, to the long hairs which cover its body this caterpillar is provided with short stout bristles, 3 mm. long. They grow from tubercles on the upper parts of the abdominal or thoracic segments, and are spread out in tuft form. These bristles are very sharp, and when the observer is pricked by them the sensation is a very painful one. It is claimed by Filipinos that these animals are very poisonous, and undoubtedly this belief comes from painful experiences with their poisonous spines. On many people the prick of these spines causes great swelling and inflammation, which may continue for some days. This is due to the fact that the spines work their way through the epidermis into the lower skin and there remain for some time. If one handles these insects by mistake the best way is to carefully pick out all the spines with a pair of pincers, using a magnifying glass, if necessary, to aid in the work.

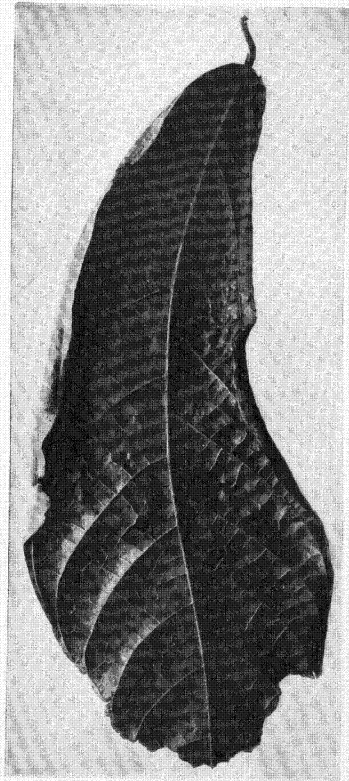


FIG. 117.

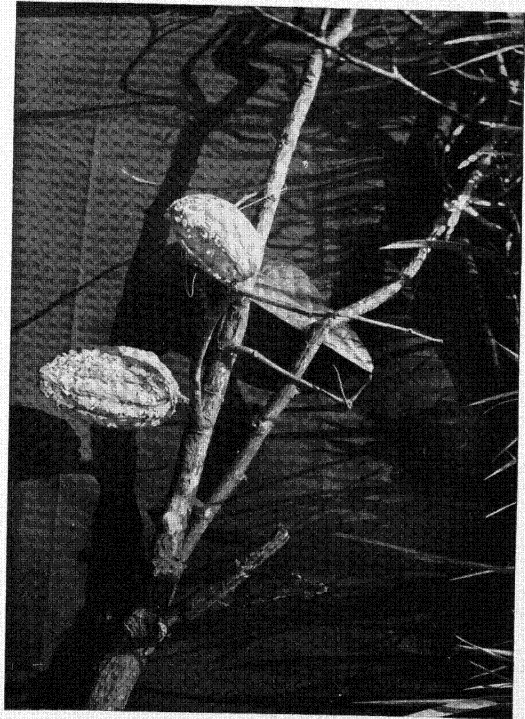


FIG 176.

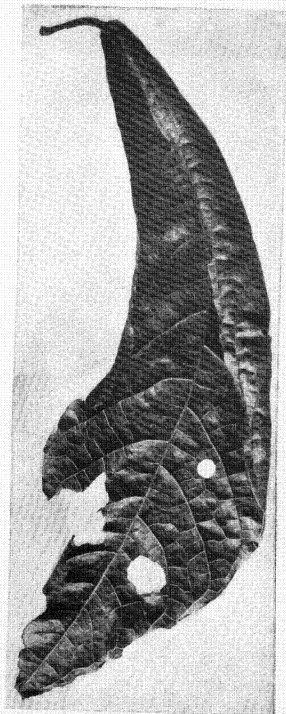


FIG. 177.

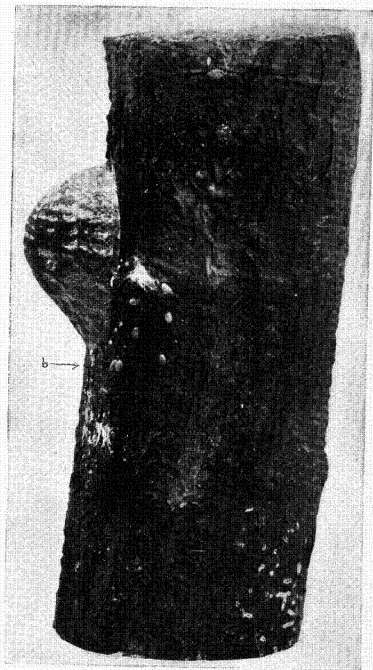


FIG. 179.

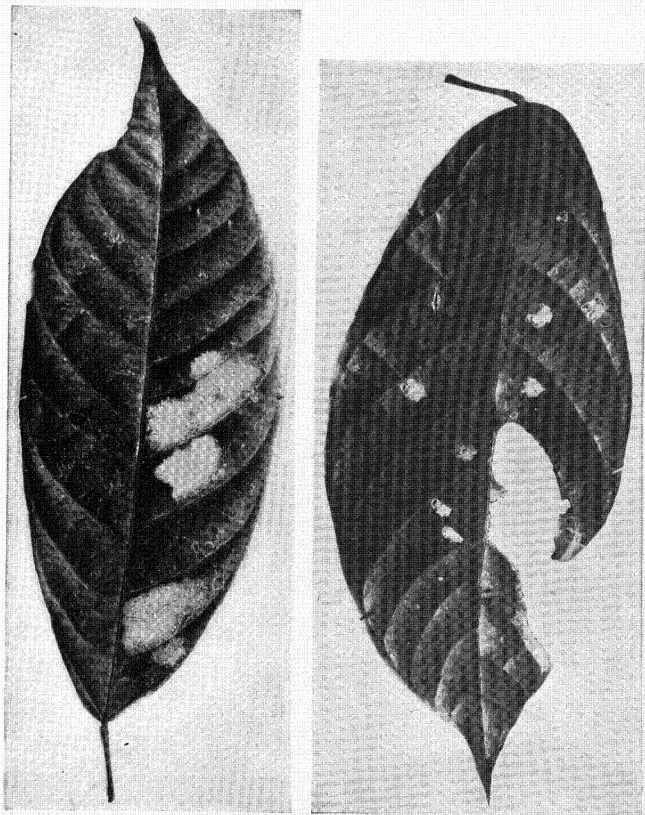


FIG. 183.

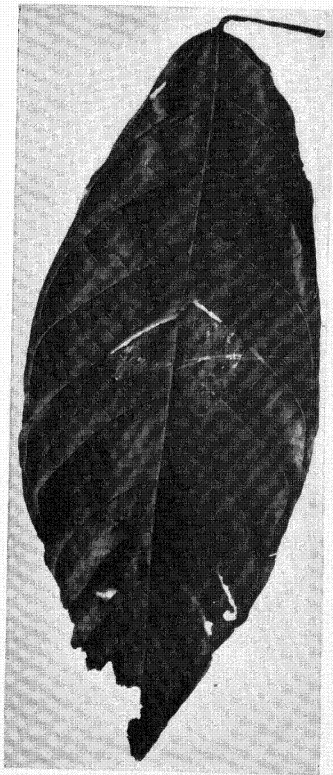


FIG. 187.

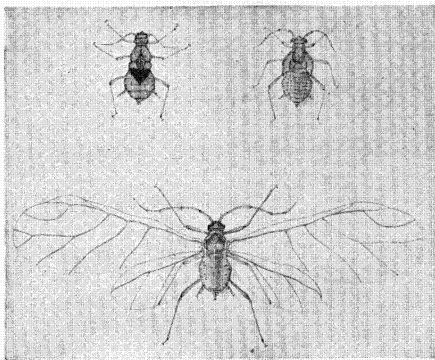


FIG. 175.

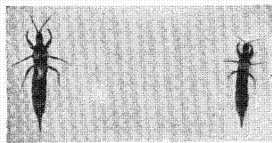


FIG. 178.



FIG. 180.

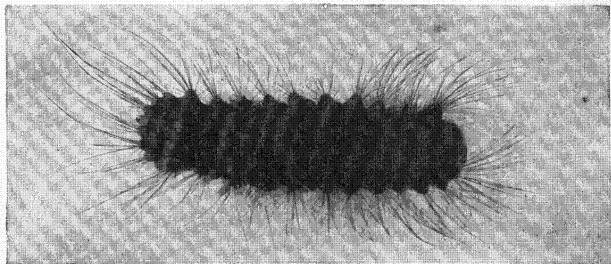


FIG. 181 (ENLARGED 2 DIAMETERS).

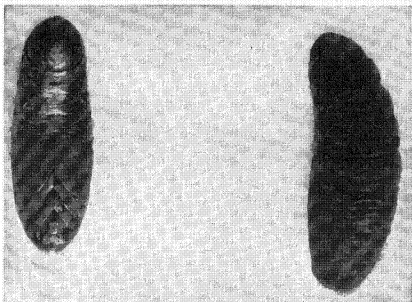


FIG. 182 (ENLARGED 2 DIAMETERS)

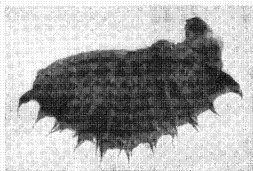


FIG. 184.

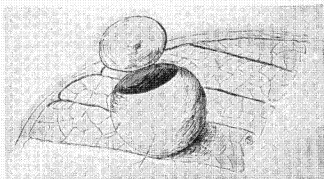


FIG. 185 (ORIGINAL).

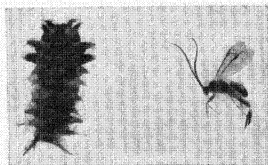


FIG. 186.—SHOWING ALSO HYMENOPTEROUS PARASITE.



The pupa is likewise covered upon certain areas with very minute spines not more than 1 mm. in length, which have the same properties as those upon the caterpillar.

The pupa of this insect is much shorter and stouter than the larva, measuring only 23 mm. in length. Fig. 181 shows the full grown larva, and fig. 182 the pupa.

The other caterpillar, which is nearly as severe in its attacks as the hairy form, is what it commonly termed a slug caterpillar. The slug caterpillar is so called from the fact that instead of possessing well-developed legs and prolegs (false abdominal legs) it has the underside of the body modified so that for its entire length it is closely applied to the surface upon which the caterpillar crawls. The form of the caterpillar is most striking, and once recognized these larvæ can not be mistaken for any other. The body which in the full grown larva measures 9 mm. long is shaped much like a slug or snail, except that it is perfectly square across the back, the sides being also perpendicular to the back. The very pronounced margin which separates the side from the back is armed with a series of erect spines of a mottled brown color with black tips. There is also a row of these spines on each side near the ventral or lower surface of the caterpillar's body. A peculiar little tubercle armed with two of these spines projects from the rear of the body and slightly upward. When feeding, the caterpillar protrudes its head from beneath its spiny armor, and when disturbed it can immediately withdraw it, pulling the forepart of the body down over it for protection. When touched upon one side the insect immediately doubles over toward that side, just as a person would do if tickled. If touched upon the opposite side it performs a similar movement in that direction. The general color of the insect is dull brown, but the under surface is pale, almost white, and very smooth. The insect secretes a kind of slime which is evidently useful to it in its movements upon the leaves, serving in place of legs to hold it. When it is about to transform to the pupa, it spins a very tough, thick cocoon which is nearly spherical in form and is attached to the leaf or the twig. This little cocoon is brown and very smooth and glossy. It bears no resemblance to anything pertaining to an insect except to the little galls formed by certain hymenopterous insects upon trees like the oak, etc. It looks more like a little dry brown fruit of some kind.

The damage that the caterpillar does to the leaves is shown by fig. 183. As the eggs are always laid upon the underside of the leaf, the insect begins by eating off the lower skin or epidermis, leaving only the veins which give the peculiar skeletonized effect shown in the figure. The insect, enlarged is shown at fig. 184, while the cocoon from which the adult moth has escaped is shown at fig. 185. In escaping, the moth pushes off a little round lid in the cocoon.

There is another member of the same family which, when full grown is somewhat larger, of a bright yellowish green with a peculiar brown mark upon the back and having a double row of tubercles on either side from which grow tufts of bristles or spines very much like those described on the hairy caterpillar of the family *Lymantiriidæ*. This caterpillar, shown enlarged by fig. 186, has habits similar to those of the other species of *Eucleidæ* except that it eats holes in the leaf, as shown by fig. 187.

This insect in the larval stage is attacked by a little hymenopterous parasite which lives within the body, devouring the fat and finally the internal organs of the caterpillar. When this parasite has reached the stage for transformation to the pupa, it spins its white silken cocoon within the caterpillar's body, and the latter may often be found dead upon the leaf looking as though it were still alive, but motionless.

Inasmuch as these three insects, like all caterpillars, obtain their food by biting, they will be susceptible to any poison which may be placed upon the leaf and which they can take into the mouth. Among the many insecticides prepared for this class of insects, those that are among the best are arsenate of lead, Paris green, and hellebore, the first named being probably the cheapest and most effective. When once the solution of arsenate of lead is dried upon the leaves, it will stand considerable rain before it will be finally washed off, and it is doubtful if it would be all removed before the insects would have secured a sufficient quantity to kill them. As obtainable in the United States, the arsenate of lead is a commercial compound, but it can be made in the quantity necessary by following the directions for its preparation in the chapter on insecticides. The preparation and use of Paris green, with other useful insecticides, will be treated in the same chapter.

Of the family *Chrysomelidæ* there has been found at least one species which does damage to the leaves of the cacao. As this beetle is very small and of an obscure color, it might be readily overlooked when searching for insects upon the plant. The female is about 4.5 mm. in length, is of an oval form, and very much rounded upon the back. The male is smaller, being 3.5 mm. long. These insects vary from light to dark brown, the majority being a very dark brown. The wing covers are very glossy and are marked by longitudinal dotted lines extending from the base to the

tip. The adults are quick in their movements both when walking and flying, taking readily to wing when disturbed or dropping quickly to the ground. They are very difficult to catch unless a bag is held beneath the leaf upon which they are resting and the latter be shaken. Even then, upon alighting in the bag they will almost immediately fly away unless promptly killed. The eggs of these insects have not been found, but like most beetles pertaining to this family, they are probably laid upon the lower sides of the leaves in patches in which the single eggs stand on end. The young grubs are very peculiar in form, being shaped like the larvæ of ladybirds, Coccinellidæ, except that their abdomens are thicker at the rear. They move very slowly and when disturbed cling to the surface rather than drop to the ground. Their bodies are covered with short black spines as a means of protection.

When young, these insects feed only upon the lower epidermis of the leaf, but as they grow larger they eat away both upper and lower skin, leaving a few of the larger veins which are too tough.

The adults, as well as the larvæ, are leaf feeders, eating through the entire substance of the latter.

As many as 20 of these beetles are sometimes found upon the same leaf, and, as each consumes an area equal to about ten times that occupied by his body, it can be readily seen that the damage done by the cacao-leaf beetle is considerable. For the combating of these insects a spray of arsenate of lead is recommended as fatal to both larvæ and adults.

Further observations are necessary in order to determine where these insects pupate. Most of the leaf eaters pupate in the crevices of the bark and in dried leaves and other secluded places, such as wounds in the tree and rubbish which accumulates around neglected trees, and doubtless these insects have the same habits. (Fig. 188 represents the full-grown beetles, *a* being the male and *b* the female, all much enlarged. Fig. 189 shows the larva of a related species.)

Cacao leaves are affected by at least two species of scale insect. This is an insect which, in the larval stage, exudes a waxy secretion, which soon forms a shell or scale which soon completely covers the insect so that none of its body is visible. This is of peculiar form, according to the species. Some are long and narrow, others are elliptical, oval, or circular, others oblong. Usually there is a prominence near the center, called the nipple of the scale. The scale of the adult consists of the successive exuvæ which have been shed by the young in its transformation. Only the adult females are found beneath the scale. They are legless, wingless, rounded masses, with no eyes. Their mouth parts consist of a very fine filament composed of three parts. This is inserted into the substance of the leaf or through the bark, and by this means the insect obtains her nourishment. Once fixed in a certain spot upon the food plant, she never moves, and probably never removes her proboscis from the place where it is first inserted. She lays her eggs under the scale, and the young come forth from beneath it to begin their own independent existences. The hinder end of the female's body is composed of a series of what are called anal plates. These are portions of chitin—the hard material found in the walls of all insects' bodies. They are lobed, and between the lobes are arranged series of bristles or spines. The form, number, and position of these plates are characters upon which are based the classification of these microscopic insects. Very frequently the food plant of the scale is used as an aid in its determination, but this is variable, as there are certain scales like the San Jose (*Aspidiotus perniciosus* Comst.) and the oyster shell bark louse (*Mytilaspis pomorum* Bouché), which have a variety of food plants. The male larvæ of the insect forms a scale, as does the female; but when it reaches the adult stage it comes forth a winged insect, similar in appearance to the one shown on Pl. I, fig. 6. A young scale insect, with its legs and other parts of the body complete, is shown on Pl. I, fig. 4. At certain seasons these minute insects may be seen crawling around upon the infested leaves or twigs, but they soon settle, usually within a few days.

It is impossible to observe or attempt to study this class of insects without the aid of a fairly good hand magnifying glass. They are so small and so little resemble insects as we usually know them that they would scarcely be taken for such by persons not familiar with the subject. For this reason they are enabled to gain a good foothold and to multiply to very great numbers unless checked by some natural enemy. In connection with the question of their multiplication, it may be said that these insects, like Aphids, multiply with very great rapidity and in numbers which are simply astonishing to those not familiar with their habits and life history. It is claimed that a single pair of the San Jose scale "will in the course of a summer in the United States become the progenitors of more than three billion offspring." Thus the cacao which might be slightly infested with scale at one time might very shortly thereafter be completely covered.

The first of the scale insects found upon the cacao, the sisi scale, so named from its resemblance to a Filipino oyster, so called in Visayan, is black, shiny, and has

the shape shown in fig. 190. It has thus far been found only upon the upper side of the leaf near the midrib. It is very slightly convex. Upon reversing the leaf a yellowish spot can be seen beneath where the scale is lying. This is caused by injury to the leaf tissue—a result of the insertion of the insect's proboscis.

The combating of scale insects has presented one of the most serious problems which has confronted not only the grower of fruit and other trees, but also the economic entomologist, during the past few years. All kinds of remedies have been tried, such as kerosene, crude petroleum, whale oil soap, hydrocyanic acid gas, lime, sulphur, and salt mixture, as well as patent articles, all of which contain some one or more of the above ingredients. Even now it is extremely difficult to say with any certainty which of these remedies or whether any of them will prove best adapted to the needs of the cacao grower who finds his trees threatened by this evil. No experiments have thus far been made anywhere in the Philippines with this class of insecticides with reference to the treatment of the scale insect, owing to the lack of the proper materials and of the machinery for their application, and also to lack of opportunity, thus far to devote to this very interesting and important subject.

Many plants in the Philippines, as elsewhere, are attacked upon their leaves, branches, and fruit by several species of insects known as the mealy bug. These belong to the same family as the scale insects, the Coccidæ, and their effects upon the cacao are only second in importance to the work of the cacao borers.

Going through a cacao grove at the time that the trees are in fruit, one notices many pods which bear a whitish fungus-like material. Upon closer examination the fungus-like growth will be seen to consist of large masses of whitish insects. These are 3 mm. long and 2.35 mm. broad, and the bodies, which are pinkish yellow, are covered with a fine powder-like substance. If examined with a magnifying glass, it will be seen that this powder extends only to the sutures or joints of the segments, and that the latter may be readily counted even in those individuals which have much of the powder. These bugs attack the fruit just after it has set and, multiplying thereon with great rapidity, often cover it entirely by the time it is ripe. They begin first in the depression or grooves and gradually spread upward upon the lobes of the pod. They crowd together in large numbers and are invariably attended by swarms of ants, whose purpose is to secure the honeydew voided by them. One of the most interesting examples of the interdependence of insects is shown in the relation of the ants to these plant lice. Upon certain pods it is not an uncommon sight to see the valleys between the lobes of the pods completely roofed over by a gray material, which upon examination proves to be a kind of crude paper formed from particles of the decayed wood of the cacao tree. Small black ants will be seen running in and out through the openings in these sheds, and curiosity upon the part of the observer leads him to break away a portion of this material in order to find out what, if anything, is beneath it. He is rewarded by finding in the grooves thus protected large numbers of the white mealy bugs, with their young and with willing servants, the black ants, attending and caring for them. The ants will be seen taking individual mealy bugs in their jaws and carrying them from place to place, and especially is this true of those that are exposed to view by the destruction of their roofs. The bugs submit to this with no sign of displeasure. If the observer watch long enough, he will see the ants building the roof or repairing the parts which have been broken away. They manifest great uneasiness when disturbed, and all those individuals which are under the roof at the moment come forth and assume an aggressive attitude, sitting up on four of their legs, with the front ones in the air and the abdomen doubled under, as if about to sting. They, however, possess no sting and only assume this attitude in instinctive imitation of those forms that do possess one.

The author has found cacao pods upon which all of the ten grooves were completely filled with the mealy bugs and roofed over by the ants. A unique feature of the fruit thus attacked was that one of the tunnels extended to the fruit stem and along the limb to the tree, and then down the trunk to a spot where the ants entered a part of the tree which was decayed. Upon opening this decayed wood the true nest of the ants, with their young in all stages, was found. This would seem to indicate that the tunnels or roofs are not built solely for the benefit of the mealy bugs, but also as a protection for the ants in going back and forth from their nests to the pods, where their "cows," as they are sometimes called, live. This double and somewhat intricate system shows in a way the wonderful provision of nature whereby through their interrelationship certain species of insects are propagated and perpetuated. It is undoubtedly true that without this provision either one or the other of the species would soon be exterminated. In as far as these animals are related to man and to his economy they must both be considered enemies—the mealy bug in being directly injurious to the product of the cacao and the ant indirectly as protecting and caring for the mealy bug in order to secure the product of its attack upon

the tree. The latter must, therefore, share with the former in any treatment looking to its extermination.

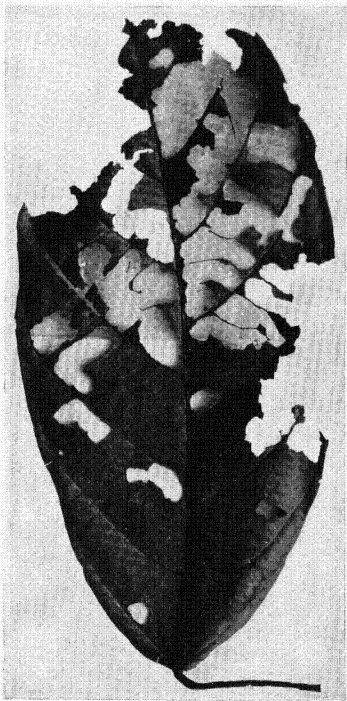
Little is so far known of the life history of this cacao mealy bug. Its eggs have been discovered in alcoholic material and the young have been found in great abundance in the deeper grooves of the cacao pod. (In Plate I is shown a ripe cacao pod upon which are represented the adult and young mealy bugs with the tunnels or sheds built by the ants. The openings of these sheds are regularly constructed, so that the ants can go in and out at certain places without disturbing the bugs.) By whatever method these insects are treated the sheds would offer but little, if any, hindrance to the effect of the insecticide, inasmuch as they are built of an extremely porous material, through which kerosene, crude petroleum, or other similar material would soak very readily. Probably the very best solution to apply to these insects would be the kerosene emulsion recommended for plant lice. Their bodies are fully as tender and delicate as those of the plant lice, and therefore the same proportions of ingredients could be used. The sheds where they were present would hold the insecticide longer in contact with the insect's bodies, and would thus be a help in the extermination of the mealy bugs. Naturally the best time to spray the trees for these insects is just after the fruit has attained the size of a small hen's egg. If successfully subdued at this time the chances are that they will not reappear.

The amount of injury these insects inflict is shown in the smaller size of the pods attacked by them, the scars which extend down into the fiber of the pods, and the general inferiority in size and quality of the beans or kernels themselves. Pods infected by these bugs are not only inferior in quality to those unaffected, but they are also very unsightly to those who have to handle and open them. I am thoroughly convinced that with proper care and judicious use of the spray pump and kerosene emulsion of a proper strength these minute pests may be entirely eradicated from the cacao grove, and clean, healthy, well-filled pods will be produced where now inferior ones exist.

There is another species very similar to the mealy bug, which has been found upon the cacao in a few instances. It is also quite prevalent upon the "Nangka" (*Artocarpus integrifolia* Linn.), covering the fruit stem and often the small twigs. It is covered with a thin white or yellowish-white incrustation, which breaks very readily upon being touched, however lightly. As this insect has been found only in a few instances, and on trees which were in close proximity to Nangka, it is probable that it will not naturally attack the cacao. However, it would be well to be on the lookout for it. Further observation will reveal the facts with regard to its preference for cacao, and its life history and habits may then be discussed at greater length.

There are few trees which have a host of enemies without at least a proportionate number of friends in the insect world, and the cacao is no exception to this rule. In many cases the insects, which in some way or another prove beneficial to the cacao, are not found solely upon this tree. This does not have reference to the parasites of the insects which affect the cacao, but includes such insects as wasps, aphids, ants, lions, and spiders, the latter not being insects in the technical sense.

Among wasps which are found upon the cacao, and which are known to feed upon larvæ and adults of noxious insects, may be mentioned the "Alingayo" and the amomo-ong, called here by their Visayan names. The former belongs to the true wasp family, the Vespidae, and the latter more strictly to the hornets. The alingayo, which is familiar to all who live in the Visayas because of its very sharp and severe sting and the fact that it often builds its nest in houses, is not more than 13 mm. in length. It is of a light-brown color with transverse bands of yellow upon the abdomen and diagonal ones upon the thorax. The second segment of the abdomen is as long as all the other segments together, and when at rest the insect retracts the hinder segments within this long one, giving it a very short, stubby appearance; but when angered and about to sting it can increase the length of the abdomen more than twice its normal length. A broad band of yellow borders the hinder edges of the second abdominal segment, which is of a deeper brown than the rest of the body. The stinging instrument is very sharp and about 2 mm. long, curving slightly downward. The eyes are slightly yellowish, the antennæ are broken or jointed at a distance from the head of about one-third of the entire length and they droop forward in front of the eyes. When at rest this insect folds its two pairs of wings down between the thorax and abdomen, and thus they lie for a part of their length below the abdomen, as shown in fig. 191*d*. The general appearance of the insect is given in the same figure at *b*. This insect builds a nest like the one shown at fig. 192. It is often as large as a man's two hands and every cell contains a grub or a pupa. The larvæ are fat, legless grubs, with no sign of eyes or other appendages and they feed upon the masticated and partly digested insects which the adult brings to them. Fig. 191*b* shows the full grown grub and fig. 191*c* the pupa, which has been removed from its cell and from the delicate silken cocoon which was spun before its trans-



WORK OF BEETLE, SHOWN IN FIG. 188.

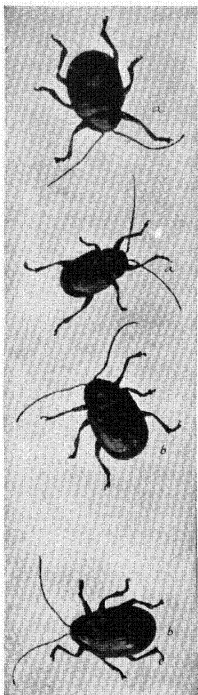


FIG. 188.

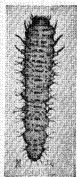


FIG. 189.

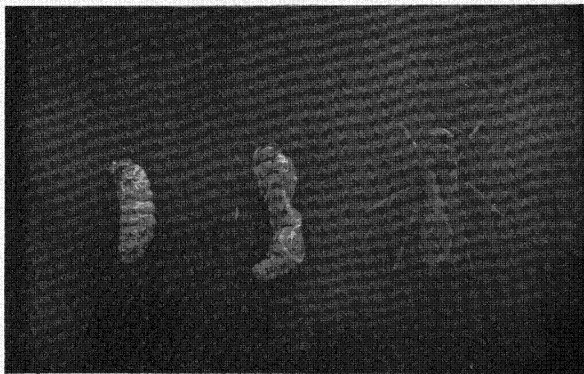


FIG. 191 *a, b, c.*

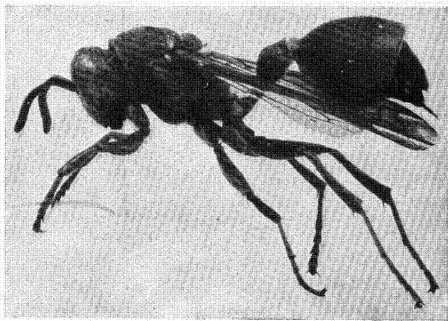


FIG. 191 *d.*

formation. Soon after changing to the pupal form the insect is a creamy white, but as the process of development goes on it assumes a darker color, beginning at the eyes, which are the first to show evidence of the true color of the perfect insect.

These insects have been seen to capture small caterpillars, and gradually chew them up into a soft mass, which they carry in their jaws to their nests. They feed upon other insects and do not disdain flies. It is estimated that a colony of 100 of adults will destroy in a month more than 3,000 caterpillars and other insects. Fig. 191 shows the larva, pupa, and adult of this interesting and useful little insect.

The amomo-ong is very much larger than the alingayo, and is one of the most beautiful wasps that I have ever seen. It is 30 mm. long and 7 mm. wide, of a jet black, with three transverse bands of orange red, one on the upper part of each of the first three abdominal segments, the second being about thrice the width of the first and third. The head and thorax are of a dull velvety black. The compound eyes are black and glossy, and in the top of the head are three little black glistening ocelli or simple eyes, forming a triangle. The wings of this beautiful insect are of a reddish brown, the fore wings measuring 23 mm. in length. They are somewhat smoky. They extend just to the tip of the abdomen. The antennæ are elbowed as with the alingayo and droop over the eyes. The legs and feet are of a color uniform with the body, and are provided with claws for grasping the surface upon which the insect rests, and for obtaining its prey. These insects have the same habits as the alingayo, but instead of building a flat nest with all the cells in the same plane, their nest has the appearance shown in fig. 193, which shows also the adult. With this nest were captured some eight adults, about half those present. These insects are valiant protectors of their homes and their young. They will remain in the nest even when struck at with poles, one or two of them darting at the intruder. When the nest has been torn away they will even come back to the same spot and attempt to build another in its place. This is contrary to the usual habits among insects, of giving up a place when once their nest is damaged or destroyed. That these insects render a valuable service in the destruction of larvæ of injurious species is beyond question of doubt. They have been repeatedly caught when returning to their nests with full grown larvæ in their claws. They carry their prey in their claws rather than in their jaws, as is the case with the alingayo, and they do not masticate it until they reach their nests.

Among the species of caterpillars which have been taken away from these wasps are those of Geometridæ, Lymantriidæ, Cetonia, and Tortricidæ in large numbers.

In all cases where not so numerous as to prove annoying by stinging unsuspecting workers among the trees, they should be left alone in their nests. Another insect which is frequently met with upon the cacao tree, and which might be mistaken for its enemy, is one of the true bugs, a Reduviid, which I propose to call the "red corsair." This Hemipteron belongs to a class of insects which are very properly called assassin-bugs, because their instinct is directed to the killing of other insects. The red corsair, a picture of which is shown at fig. 194a, is a very showy insect, having a black underbody with red thorax and red wings. The head and feet are black, as are the antennæ. The insect measures 17 mm. long and 5 mm. wide. The head, which is very long and narrow, has a peculiar beak which curves under toward the thorax. This is very sharp and is used for sucking the blood of insects which the red corsair captures. (Fig. 194 shows a dorsal view of the insect, while at 194a it is shown with the head and beak much enlarged.) The nature of the beak can be readily seen from the drawing.

This insect moves very stealthily about upon the surface of the leaf and pounces upon whatever insect it may find. It has been observed most frequently feeding upon geometrid caterpillars, which it holds between its fore feet while sucking their blood. When not seeking its prey it rests quietly with its legs spread far apart and the body suspended above the surface upon which it is standing.

If caught in the fingers this insect is liable to inflict a sting with its beak, which, while not poisonous, is very painful, to say the least, and with some persons this may result in a painful swelling. They do not, however, need to be handled, and the good they do on the trees in the matter of destroying noxious insects is of incalculable value when compared with the occasional bites they may inflict on those who carelessly handle them. Their eggs are laid in crevices of the bark, and when the young come forth they look very much like the adults, save that they have no wings. The young also feed upon small larvæ and other insects. Stål, in his "*Hemiptera Insularum Philippinarum*," calls this insect *Sphodronyttus erythropterus* Burm., var. *corvus* Stål.

In a cacao plantation in which the top soil is sandy, and in which there has been no rain for some time, one will very frequently see around the bases of the trees a number of cone-shaped pits with the sides, which are composed of loose sand thrown at an angle of about 45° to the surface of the ground, coming to a point below. If an

ant or a fly be tied to a string and let down into the bottom of this pit it will be at once seized by a pair of jaws which is lying concealed in the sand. If the observer be quick enough he may succeed in jerking out a peculiar looking gray insect resembling a large-sized louse and, in fact, so called by the Visayans, who name it *cotu-cotu*, meaning a big louse. This animal, which measures when fully grown 12 mm. long and 5 mm. wide, is the larva of a very delicate and beautiful insect of the family Myrmelidonidae of the order Neuroptera. The adult measures about 29 mm. in length and has an expanse of wings of about 60 mm. The wings are iridescent and the general color of the insect's body is a smoky gray. The eyes are rather large and spherical, being prominently set, like those of the damsel flies, relatives of the dragon flies, or, as they are called in Visayan, *tumbuc tumbuc*. One would never associate this delicate insect with the voracious *cotu-cotu*.

The larva has habits which are as strange and incongruous as its appearance. Its two forcep-like jaws are adapted solely to sucking the blood of unfortunate insects which drop into the pit which it has dug for them. It invariably moves backward instead of forward. If dropped upon a sandy spot it almost instantly disappears. It uses its tail end as a sort of shovel to dig its way into the ground. Its method of constructing its pit is interesting in the extreme. After working its way below the surface it begins to move around in a circle, the diameter of which is in proportion to the size of the insect and consequently in proportion to the hole which it will finally have excavated. When it has completed its circle it begins throwing out the sand with its head, which serves as a shovel. As the sand is thrown out the larva gradually moves toward the center of the pit, which, from the force of the caving sand on the sides, begins to assume a conical shape. When the ant-lion, for such it is called in English, encounters a pebble or small stone it immediately lifts it upon its opened jaws and attempts to throw it out. It can throw out a stone which weighs much more than its body. When the pit is completed the ant-lion goes into the sand at the apex of the cone-shaped hole and with only its jaws and its eyes protruding it awaits the coming of some unwary insect. It usually has not long to wait, for, as a rule, ants and such crawlers are very curious when they come to a hole. They invariably like to investigate, and peering over the edge of this pit they lose their balance and begin to slide down. Their downward motion is very much accelerated by the action on the part of the ant-lion, which immediately begins to throw sand up over them; this takes the sand away from under their feet and in a shower of the material they are gradually forced back down into the pit. Finally reaching the bottom completely exhausted, they are seized upon by the skillful foe, dragged under the sand and their blood sucked out. Afterwards their dried skins are flung out of the pit by the ant-lion. (Fig. 195 shows two views of the ant-lion's nest, one being sectional, with the insect seen at the bottom. Fig. 195a is the larva.)

The ant-lion will not attack large insects like beetles or big spiders, which occasionally fall into its pit, but remains quiet until the intruder can get out. It will attack the termite, any kind of ant, small flies and bugs, and it has been seen to drag small moths under the sand. When ready to pupate, the ant-lion spins a spherical cocoon of grains of sand fastened together by a beautiful pearly white silk, with which it is also lined.

This insect can certainly be called a decidedly beneficial one, for of all the insects which it has ever been seen to take, not a single one was other than noxious, and the number of ants and any which it captures and kills in course of its somewhat lengthy larval stage must be great indeed.

To the Orthopterous family Mantidae belong several very peculiar-looking animals which have received the attention of even the most careless observers from time immemorial. They are called mantis, devil's riding horse, camel horse, mule killer, etc., in English and *tagat-tagat* in Visaya. In Tagalog they are known as *Sa-sambá*. Unlike most Orthoptera they are carnivorous, living upon other insects and are therefore to be classed as beneficial.

They lay their eggs upon the twigs of the cacao and other plants, and as many as 200 of the young hatch from an egg mass such as is shown by fig. 196. The young are very much like the adults in appearance. (Fig. 197 shows a young mantis and fig. 198 an adult.) The fore legs are fitted for grasping the prey. They often remain motionless upon a twig for several hours, but if an insect comes within reach they immediately, with great rapidity, grasp it in their forefeet and proceed to eat it, only rejecting the harder parts and the wings. After feeding they very neatly clean their faces, antennae, and front feet, and again begin their watch. They run readily and are also good fliers. They rest entirely upon the two hinder pairs of feet. They have the habit of sitting up and watching the observer, who in turn becomes the observed. The large eyes and peculiarly shaped head, together with the large body, make them objects of very grotesque appearance.

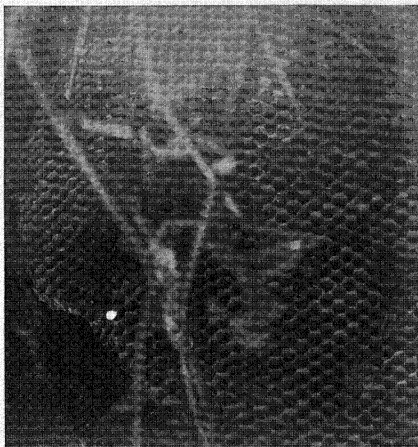


FIG. 192.

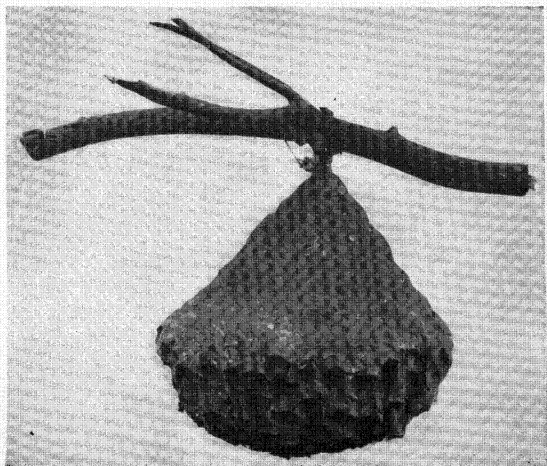


FIG. 193.

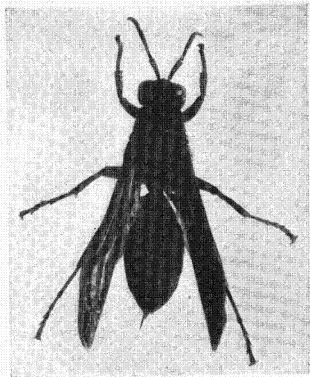


FIG. 193.

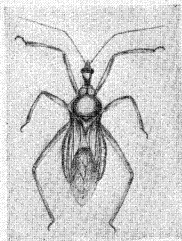


FIG. 194.

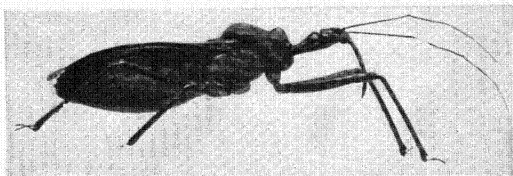


FIG. 194 α.



FIG. 195 (DORSAL VIEW).



FIG. 195 α.

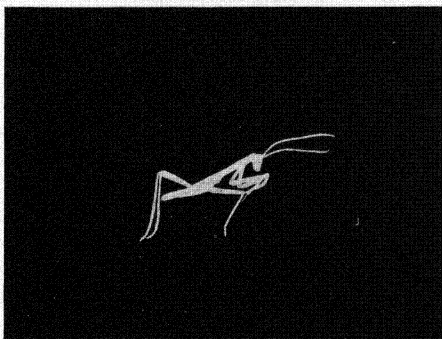


FIG. 197.



FIG. 198.

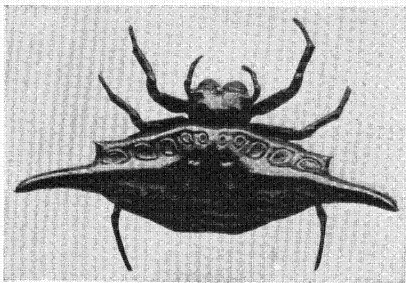


FIG. 199.

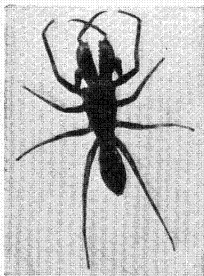


FIG. 200.

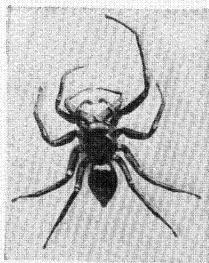


FIG. 200b.

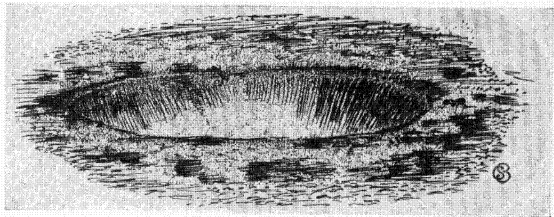


FIG. 195 *a*.

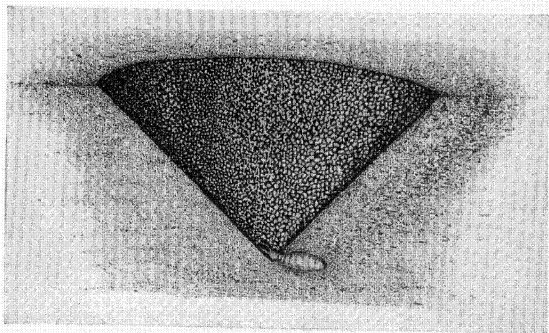


FIG. 195 *b*.

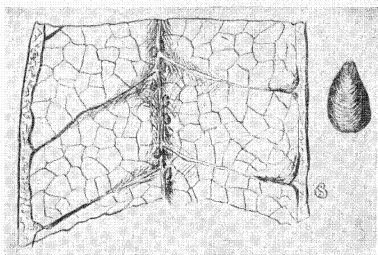


FIG. 190 (ORIGINAL).

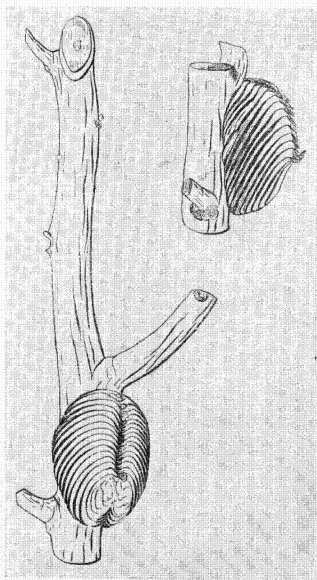


FIG. 196.

The large spiders which live upon the cacao and which undoubtedly do it a service by the number of insects which they capture and devour, renders them the subject of special attention, although they do not come under the technical classification of insects.

Among those which have been found most abundantly are the orb weavers, the jumpers, one species of tarantula, and many species of crab spider or Thomisidæ. Perhaps the most peculiar, and one of the most beautiful of the orb weavers, is the crescent spider, which is illustrated by fig. 199. It has the abdomen shaped in the form of a perfect crescent, and is of a beautiful jet black and yellow, and the horns at the sides of the abdomen are pubescent at their tips. This spider builds a true orb web and catches many insects, the most of which are harmful to the plant. Among these have been noted plant lice, moths, plant bugs, and small Coleoptera, like Scolytidæ, Chrysomelidæ, and Scarabacidæ, all harmful classes.

The crab spiders are so called because of their resemblance to crabs in form and arrangement of the legs. They are of a light color, usually like the flowers which they inhabit, and lie concealed in the clusters. They seize plant lice and other small insects as they come to the flowers. Undoubtedly they occasionally capture beneficial insects, like hymenopterous parasites.

The majority of spiders found upon the cacao belong to the jumpers or Attidæ. These spiders are sure to attract the attention of the observer because of their peculiarly beautiful and varied colorings and their activity. They are light green, golden yellow, brown and red, black, gray and of many other and striking colors. They are extremely active, jumping forward or backward or sidewise with equal celerity, and they invariably capture their prey by pouncing upon it. Their eyes glow with what appears to be internal fire and their position on the head and their form suggest in a most remarkable way the headlights on an automobile.

A most peculiar and common form of the Attidæ are the ant-like jumpers. They vary in length from 3 to 10 mm., according to the species, and their resemblance to black ants is so very close, not only in form but in their movements, that they often deceive the close observer. They run upon only six legs, carrying the two fore legs high in the air and moving them with the same uncertain motion that ants use when moving their antennae. They will run a short way, then stop and wave their front feet, then start off sidewise, then back up, and, before one knows what they will do next, have pounced upon some unsuspecting fly or bug. In form of body and movements they really represent one of the most striking cases of mimicry. (Fig. 200 shows examples of the ordinary jumping spider and the ant-like form.)

At the base of the cacao one frequently sees a hole 15-20 mm. in diameter, carefully and neatly lined with snowy white silk, which sometimes extends out upon the ground for some little distance. If one will dig out this hole, following its twists and turns at the inner end, which is usually 40 or 50 cm. in the ground and parallel with the surface, if the ground be level or horizontal, if the hole be in the side of a hill or mound around the tree, he will be almost sure to find a most beautiful dark brown hairy spider of the tarantula family, Theraphoridæ. This spider measures when extended, including legs, 85 mm. long and 65 mm. broad. Its brown velvety coat is almost black when it is seen curled up against the white background of its silken cell. If one of these spiders be examined after being killed it will be seen to have two very strong, curved, brown, forcep-like mandibles which, instead of approximating point to point as in most spiders, are bent forward and downward so that the tarantula can not really grasp its prey with its jaws. It is, however, provided with two foot-like palpi which serve to hold its food while it is being eaten. These palpi give the tarantula the appearance of having 10 legs instead of the true number which all spiders have, namely, eight.

The area around the mouth is covered with golden reddish hairs. This characteristic seems to be common to most of the tarantula family. The spider feeds upon most kinds of insects; the exuviae of several larvæ and pupæ being found in some of the nests opened. It seems to show a great preference for cockroaches, several of their skeletons having been found in its abode.

A word should be said before concluding this paper regarding some other animal pests of the cacao. In all parts of the world great trouble has always been experienced in cacao growing because of the ravages of rats and mice. These little rodents, working at night, often do an incalculable damage to the fruits, destroying many pounds of the nuts in a season. (Fig. 201 shows cacao pods, each with a hole in the side just large enough for the small rodent to enter.) It very skillfully removes all the kernels from a pod and leaves it hanging on the tree, where it dries if not removed by the grower.

No effective remedy has been devised for this pest, but the writer would suggest that an excellent one can be found in the discarded pods after the ripe nuts have been removed. The pulp on the inner side of the pod being scraped out and mixed

with some kind of effective poison, like arsenic or paris green, is replaced in small quantities in each pod. The pods are to be then fastened together with two bamboo toothpicks and the decoys placed beneath the trees, two or three under each. It is more than likely that the rats, finding these upon the ground, will attack them first, and gnawing into them will eat the sweet pulp within. The results will then remain to be seen, but certainly the chances of success are very much in favor of the growers. All hogs and other domestic animals should be excluded from plantations in which these experiments are being tried, and the refuse should be collected as soon as it is seen that the pods have been gnawed into by the rats, and buried at a sufficient depth to insure its not being dug up by hogs. As the pods are liable to shrivel and open during dry weather, they should be renewed from time to time as occasion will require.

Very little can be said at present concerning insects attacking the dried product of the cacao, namely, the beans and husks. In visiting various wholesale establishments for the handling of cacao in Manila, beans have been found giving evidence of the work of some form of the common dried fruit moths, but thus far neither the larvæ nor the adults have been discovered.

Chittenden in his bulletin on a "Some Little-Known Insects Affecting Stored Vegetable Products," says the following in connection with a moth which he calls the chocolate moth. I would, however, suggest that instead of being called the "chocolate" moth it be called the cacao bean moth, as it is more frequently found in the bean than in the manufactured chocolate.

"The habits of our flour and meal-feeding *phycitids*, *Ephestia kuehniella* and *Plodia interpunctella*, are so well known as to necessitate no further comment here, but there is still a fourth moth which, although represented in our faunal lists, seems never to have received mention as an injurious species in this country. I refer to *Ephestia elutella* Hbn. Its habits have been known in Europe since early in the last century, yet so far as I know at present American records show nothing positive regarding injuries.

"Reaumer's account of the moth that injures chocolate, published in 1737, is generally conceded to refer to the present species and as it is this species that is most often associated with the chocolate nut of commerce it may be called the chocolate moth. Recent study of bred material shows this to be the moth mentioned in Insect Life (Vol. IV, p. 332) as having been received at this office from Mr. H. F. Wickham, who found it injurious to cayenne pepper in one of the drug houses at Iowa City, Iowa. We have also specimens bred from dried apples obtained from a New York City dealer and submitted to this office by the Division of Chemistry, and others from cacao beans received from Mr. C. A. Barber, who obtained them from Montserrat, West Indies. According to various European authorities, this species also attacks manufactured chocolate, coffee, and various dried fruits, and even does considerable damage to ship biscuit, which it injures after the manner of *E. kuehniella*."

It may prove that the above-mentioned species is the one which has been found in the cacao in Manila and the possibility is more strongly emphasized by the fact that the condition of the beans, the class of holes made, and the frass contained within the beans, all point to the work as that of a *Phycitid*.

Certain beetles of the families Tenebrionidæ, cadellus or darkling beetles, and the Nitidulidæ or sap beetles, are also found in stored vegetable products as well as in decaying or overripe fruits and on wounds in trees, the sap of which they suck. For these insects, as for all others which are found in stored products, it is difficult to suggest an effective preventive, inasmuch as the pests find such ready means of entrance through the meshes of the sacks. Even where the adult insects can not themselves get into the bags and sacks, instinct seems to lead them to lay their eggs upon the outside and the tiny larva upon hatching find easy ingress. Once inside the insect passes through its transformations, but upon becoming adult it can not escape and continues to multiply.

Frequent handling of the contained cacao and a careful shaking of the bags, afterwards placing them in bright sunshine, renders the cacao less liable to be attacked by any form of insect which would eat the dried nut.

Where prevention has failed, or where infested cacao is received by the dealer, the best plan is to submit the full sacks or, better, the contents, if possible, to the fumes of carbon bisulphide in a closed bin or other absolutely tight receptacle. If an airtight room can be had, the sacks may be left in it for two or three days or even longer without any harm being done to the beans, and with the perfect assurance that all insects contained therein will be exterminated. At the end of that time the bin or room should be opened and thoroughly aired and the cacao spread out in a draft or in the sunlight.

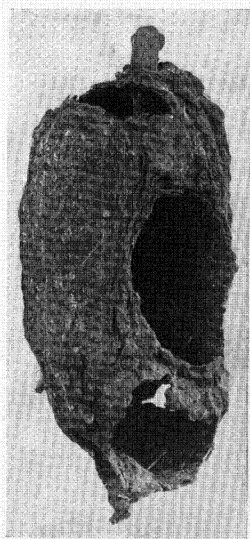


FIG. 201.

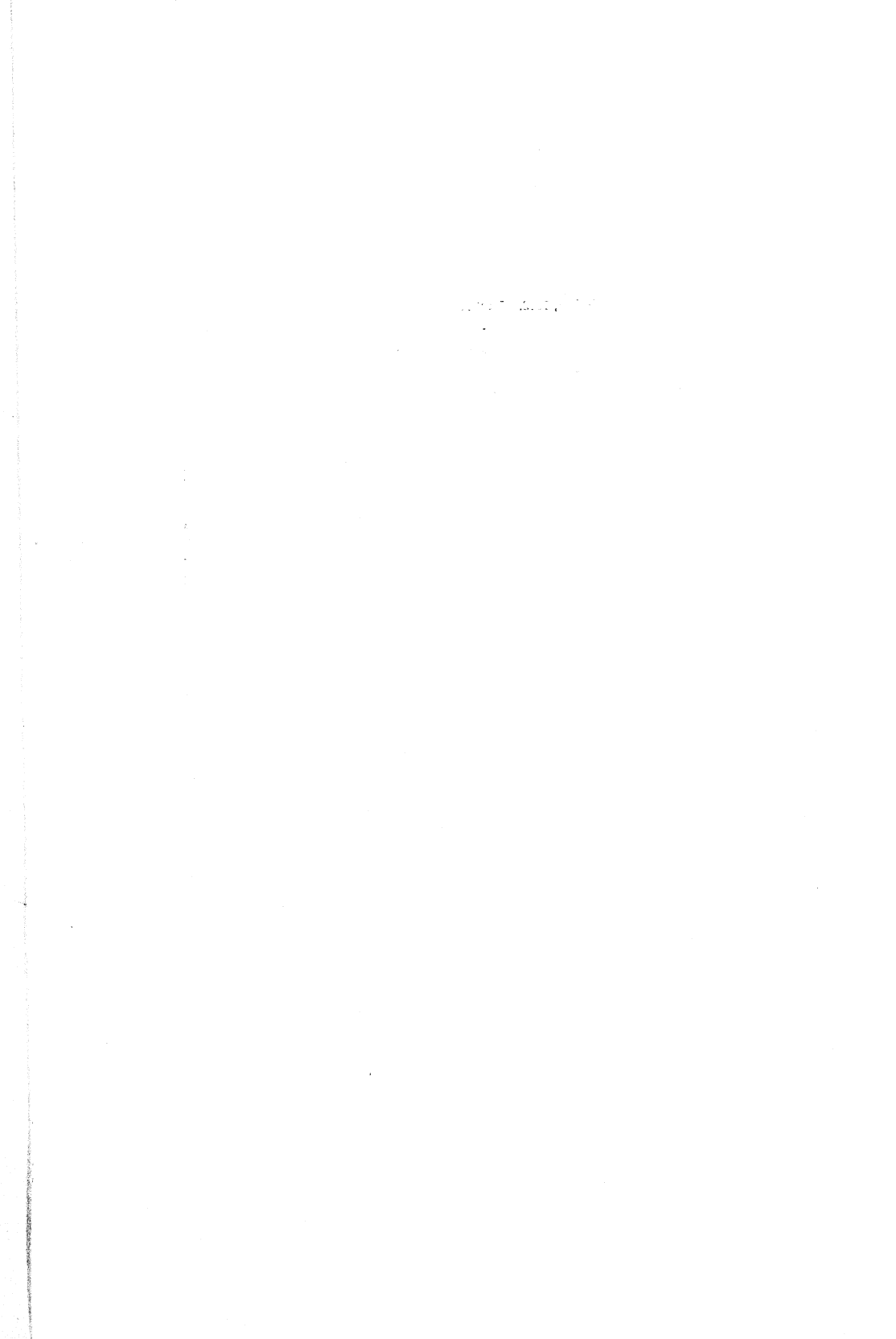




FIG. 202.



FIG. 202.

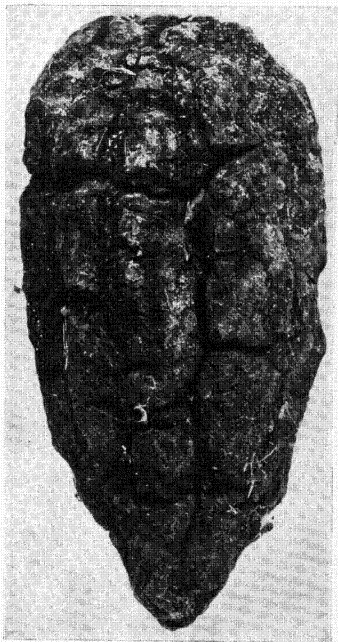


FIG. 203.

Under no conditions should a lamp or other light be permitted in a room where the carbon bisulphide is being used nor should persons remain in the room. If a bin be used, the bisulphide may be put on top of the cacao in a small dish, allowing 30 to 40 grams for every cubic meter of space. As the bisulphide is heavier than the air and very volatile, it will evaporate quickly and settle downward in the bin, suffocating all insects therein. If a room be used, the vessel may be put upon a high shelf or upon some object so that it will be as near the ceiling as possible. In this way the entire room will be fumigated.

Although the question of plant diseases like fungi, rust spots, mold, and rot do not belong to the province of the entomologist to investigate, the fact that these diseases were given some attention by him during his investigation of cacao insects will warrant a few words being said upon them and suggestions being made for their prevention upon the leaves and fruit of this valuable plant.

There are four types of fungous attack which have been most frequently met with, namely: Cacao leaf spot, cacao leaf blight, cacao pod spot, and pod scab. The first of these diseases attacks the leaf in spots as suggested by the name. (See fig. 202.) These spots are irregular in shape and in an advanced stage are a dull, whitish gray, as though the leaf had been scorched to an ash at the point, which dries and breaks off as if the leaf had been held in the fire. The type of fungus disease which attacks the pod is very characteristic, and will be recognized by the growers at once as that represented in fig. 203. Both of these attack the fruit in all stages of its growth. The pod spot occurs in spots similar to that which attacks bean pods in the United States. The spots soon completely cover the affected pod and not only cause a very unsightly growth, but also materially affect the development of the fruit. Fruits which are thus affected are smaller and the beans are found to be misshapen and in some cases not developed. The history of this disease, its causes and morphology, are yet to be investigated.

The pod scab is undoubtedly the worst form of disease which attacks the cacao. It is recognized in its advanced stages by the fact that the pod becomes dry, either upon one side or over its whole surface. It then cracks open in unsightly gashes as though hacked with a knife. Of course, the contained beans in such pods are worthless. There is another disease of which the causes are not clearly known.

Although diversified in their modes of attack, it is undoubtedly true that the same means of prevention will apply to them all since they are fungoid or bacteriological in character. Many thorough tests, covering a period of several years, have demonstrated the efficiency of a mixture of copper sulphate (blue vitriol) and quicklime, commonly called Bordeaux mixture, for nearly all kinds of fungus diseases affecting plants. The blue vitriol is the fungicide or destroyer of the fungus spores and the lime is added to keep the vitriol from burning or scorching the leaves or fruit. This solution, a formula for which will be given under insecticides and fungicides, will of course, have to be applied to the trees by means of spray pumps and a very fine spraying nozzle.

The writer is well aware of the fact that in the limited time during which he has studied the questions of insects and diseases of the cacao, many forms and conditions have escaped his notice, but as this is only a preliminary bulletin and issued so that the grower may have something at hand to guide him in the recognition of and dealing with the most important pests, the fact that all pests are not treated will not detract from its usefulness. He would be under great obligations to all growers of cacao to whom this bulletin shall come if they will send him suggestions of methods which they have tried with success.

There is a disease called "die back," mentioned by Mr. Lyon in his bulletin on cacao, which I have not found in the Philippines, and he would be grateful for specimens showing this disease.

The production of cacao has such a favorable future in these islands that any measures which will tend to a better degree of cultivation, and a more thorough protection of trees from unnecessary ravages, should be welcomed by growers and prospective growers throughout the Archipelago.

SOME INSECTICIDES AND FUNGICIDES; THEIR USE AND PREPARATION.

Insecticides and fungicides have for their object the prevention of the attacks of insects or fungus diseases, or the killing of forms already present either upon the plant or other substance affected by the insect or the disease.

With reference to insects, there are two kinds of insecticides, the internal and the contact. Of the latter there are the corrosive poisons, which attack the substance with which they come in contact, and the suffocating poisons, which act upon the breathing apparatus, producing suffocation. Among the most important of the internal poisons are those which have as a basis some form of arsenic. This sub-

stance in any form is deadly to all animal life. As there are many forms of arsenical insecticides, only those which are considered as of value in connection with combating of cacao insects will be mentioned.

Internal poisons are those which are intended for the insects which eat the substance of the leaf or other part of the plant. Applied to the surface of the leaf, either as a powder or as a solution, it is taken by the insect along with its food, and, acting upon the alimentary canal and other internal organs, accomplishes its work.

Contact insecticides are those which coming in contact with the body of the insect produce a condition, usually of the nature of a corrosive, which results in death. To this class belong ashes, lime, kerosene, carbolic acid, crude petroleum, pyrethrum, and smoke.

Suffocating poisons are those which, entering the tracheæ, either clog them up or paralyze the muscles of respiration, thus killing the insect. To this class belong carbon, bisulphide, naphthaline, benzine, petroleum, kerosene, whale-oil soap, and the fumes of hydrocyanic acid gas.

Arsenate of lead.—This insoluble chemical compound is prepared as follows:

	Grams.
Lead acetate	200
Sodium arsenate	50

Dissolve each ingredient in 16 liters of water, separately, in wooden or stone vessels. Then pour these at the same time into a barrel or tank containing 450 liters of water. The mixture should be stirred constantly and rapidly while making. Inasmuch as the compound which is formed (arsenate of lead) is insoluble, it is precipitated as a white powder and must be kept in suspension. In order to make this mixture stick well on the foliage to which it is applied, about 2½ liters of glucose or grape sugar are added to it before spraying.

Paris green.—This is an acetic-arsenite of copper and contains from 55 to 60 per cent of arsenious acid. It is a bright-green powder, very heavy, and hence does not stay suspended in the water of a spray pump unless continually agitated. As it does not dissolve in water it will, when pure, not “burn” the foliage of even the most delicate plants. If, however, twice the amount of freshly slacked lime be added with a given quantity of Paris green, all danger from free arsenic will be averted, and there will be no danger of “burning.”

Paris green would undoubtedly prove an excellent poison for mice if applied mixed with meal or bran and the pulp of the cacao. The proportion should be 1 part of the Paris green to 50 parts of meal or bran.

In using Paris green as a liquid insecticide it is applied as follows:

Paris green	grams..	450
Lime (fresh slacked)	do.....	900
Water	liters..	1,500

This is a cheap insecticide, is in universal use, and if care is used to keep it in suspension in the water while spraying, it will give as good results as any of its class.

Numerous other arsenates are sold under the following names and others: White arsenate, pink arsenate, white arsenoid, parine green, laurel green, London purple, paragrene, and green arsenoid.

Kerosene.—This is a refined product of petroleum which is so well known as to render a description unnecessary. Applied pure to any kind of insect it immediately destroys life. It is likewise fatal to plant life if undiluted. Used in a mechanical mixture with water it is a remedy against scale insects and plant lice. A safer and much more effective preparation is the kerosene-soap emulsion, which is prepared as follows:

	Per cent.
Kerosene (9 liters)	67
Common or whale-oil soap (225 grams)	} 33
Water (4.5 liters)	

Heat the solution of soap and water and add it, boiling hot, to the kerosene. Churn the mixture by means of a force pump and spray nozzle for five or ten minutes. The emulsion, if perfect, forms a cream, which thickens on cooling, and should adhere without oiliness to the surface of glass. The above formula gives 12.25 liters, and makes, when diluted, 120 liters of wash. (Report of the Entomologist: in Report of the Comr. of Agr. (U. S.) for 1883, p. 152.) Another formula which may be of interest is the following, taken from Dr. J. A. Lintner's Second New York Report on Inj. Ins., 1885:

“Eight parts of water and one part of soft soap, thoroughly amalgamated, forms the lye, which takes mineral oil and thoroughly mixes with whatever proportions

of the oil be added. As heat aids much in quickly producing thorough amalgamation of the ingredients, boil the soap and water together, and, when ready, turn into ordinary wine bottles (costing little or nothing, especially in the Philippines), which have been placed in boiling water. About half fill the bottles, turn 125 c. c. of the oil into each bottle, then fill up with the boiling lye. Cork at once and store away for use.

"When required for use, a bottle of the mixture is poured into an 18-liter watering pot which is filled up with soft water and is ready for use, at a strength of 70 c. c. to 4½ liters of water (1 part oil to 64 parts of water in about 1½ per cent). Seventy cubic centimeters of oil to 4½ liters of water is strong enough to kill Aphides (the plant lice in question), and such soft-bodied insects. By bottling the mixture as above, no mistake need be made in using it of proper strength."

Whale-oil soap.—A preparation made of fish oil with lye. Effectual against scale insects and plant lice, and when mixed with carbolic acid makes an excellent detergent for borers. When used as a spray for plant lice, the proportions should be:

Whale-oil soap	grams..	450
Water	liters..	45 to 90

This should be thoroughly dissolved before using, and the weaker solution is advised for trees when in young leaf. Even 450 grams to 125 liters of water is not too weak. If ordinary soft soap or turpentine soap be used the following are the proportions:

Common soap	grams..	450
Water	liters..	18 to 36

Another excellent preventive which has been used most successfully against the peach borer in the United States, and which would probably prove of equal value to that of the carbolic wash, is what is known as the lime, coal-tar and whale-oil soap wash. It is prepared according to the following formula:

Unslacked lime	kilos..	25
Coal tar	liters..	6
Whale-oil soap	kilos..	6

The lime and tar should be slacked together with water sufficient to make the whole of the consistency of white paint. The whale-oil soap is dissolved in hot water and added to the lime and tar solution. When water is added sufficient to make the whole mass as thick as ordinary thick paint, it may be applied to the tree.

Tobacco wash.—This very effectual remedy against plant lice has certainly the advantage of cheapness in a country where tobacco is abundant. It is applied as a spray after being prepared as follows:

Dry stems or tobacco leaf	grams..	225
Water	liters..	4.5

Steep over a slow fire for some hours, then, when ready to use it, dilute the quantity with 25 to 50 gallons of water.

Carbon bisulphide.—This is a colorless liquid, resembling refined kerosene in appearance. It is of a very disagreeable odor and extremely volatile. It can not be handled around fires, and even smoking while using it is dangerous. It is explosive and also takes fire very readily. Its vapor is heavier than the air; hence it should be placed above whatever it is desired to fumigate. In closed bins or in rooms the proportions to be used are 450 grams for every 27 cubic meters, or 17 grams for every cubic meter. Whatever it is placed into should be perfectly tight in order that the fumes may not escape.

Bordeaux mixture.—This valuable fungicide has as its essential ingredient the sulphate of copper, commonly called blue vitriol or bluestone. It is prepared as follows:

Copper sulphate or blue vitriol	kilos..	1.80
Quick lime (unslacked)	do..	2.25
Water	liters..	225

The copper sulphate should be dissolved in half of the amount of water, or 100 liters, in a wooden vessel, such as a half barrel. The lime should be slacked in the remainder of the water, and when ready for use the two solutions should be poured together into the spray-pump barrel or tank. In order to save time a stock solution of each substance should be made and kept on hand.

First slack in a wooden vessel 22.7 kilos of lime. This should be immediately strained into a barrel holding 225 liters and the barrel filled with water. Cover the barrel to prevent foreign matter from getting into it.

The copper sulphate stock solution should be prepared by dissolving 18.1 kilos of the crystal in 225 liters of water and putting it into a barrel, covering the same.

When it is desired to use Bordeaux, take 22.5 liters of each solution and add enough water to make 225 liters of the Bordeaux mixture.

At the present time the question of spraying in the Philippines is a very serious one, owing to the fact that none of the goods of large and reliable firms of spray-pump manufacturers are represented in the Philippine market. For several years past the United States Government has carried on experiments for ascertaining the best apparatus for combating insects on a large scale, and, as a result of its work and the experimentation of individuals, there are now upon the American market several very excellent spray pumps which, considering the ease of manipulation and the fact that they will last for several years if given proper care, are very reasonable in price.

The principal essentials of a good spraying apparatus are that it deliver a fine spray, that it keep the mixture to be sprayed in constant agitation in order that the ingredients may be kept in uniform suspension, and that it have sufficient capacity so that a reasonable amount of the insecticide may be made and used at one time.

The two types of spraying apparatus which would give the best results in cacao plantations are the barrel pump and small power spray pump. The former would be useful in small plantations of not more than two or three hectares and the latter for large ones. With a barrel pump and two nozzles and three men to operate it in the orchard, from 50 to 75 cacao trees could be sprayed in a day. With the power spray pump a proportionately larger number of trees can be treated. The best nozzle is one which will break the liquid up into the finest particles possible and at the same time is not liable to clog, or, if clogged, may be easily cleaned.

PARTIAL REPORT OF THE WORK OF MR. J. J. EATON, PREPARER OF WOOD SECTIONS IN THE BUREAU OF GOVERNMENT LABORATORIES FOR USE OF THE BUREAU OF FORESTRY.

This report simply gives an outline of the methods employed and the class of microphotographs produced. The complete work will be published by the Bureau of Forestry.

Forty-eight samples of different kinds of woods taken from trees in the Philippine Islands were received, and sections of them cut. All of the commercial groups of wood were represented, there being 8 of the superior groups, 3 of the first, 13 of the second, 7 of the third, 4 of the fourth, 1 of the fifth, and 12 not in the classified list.

Almost all of the samples received were 2 cm. square and 4 cm. long. From these small pieces were cut in such a manner that surfaces parallel to the annular rings, parallel to the medullary rings, and cross sections were obtained. These surfaces were about 12 mm. square and not over 3 mm. in thickness. It is recommended that hereafter the samples submitted be at least 10 cm. square and 5 cm. thick, in order that the tissues may be properly selected.

The first step consisted in finding some method of softening the wood tissues and of removing all salts and other substances that might interfere with the sectioning, and yet not destroy or rupture the cells of the material.

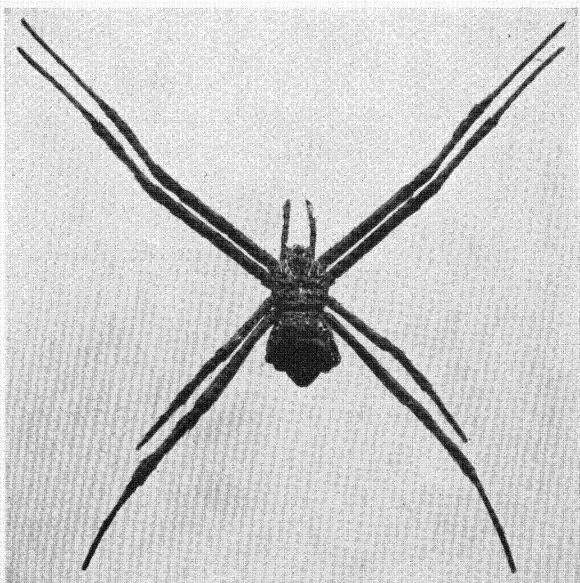
Various suggestions were obtained from the work *The Microscope and its Revelations*, by W. B. Carpenter, but they were not applicable to most of the hard-wood specimens received. Some of the methods suggested were tried as follows:

Several small pieces of the wood "tua" were boiled in a 10 per cent solution of nitric acid for ten minutes, then placed in hot alcohol, not boiling, for thirty minutes, and afterwards boiled in water for fifteen minutes. These pieces were not softened to such a degree as were others by a different method, while the surfaces appeared to have been attacked by the nitric acid. They were consequently discarded, together with the method.

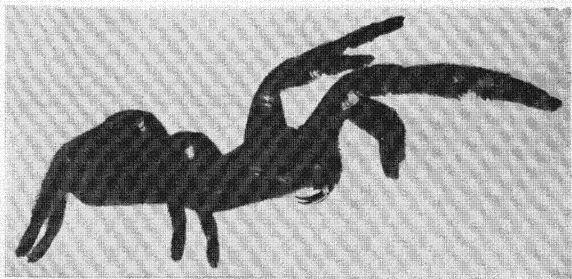
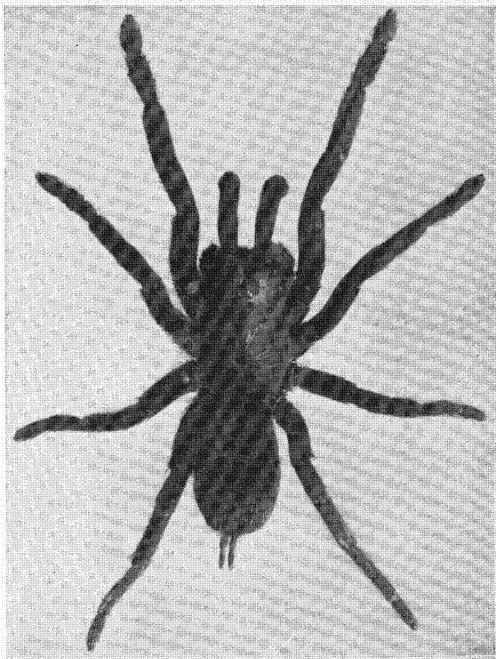
Samples of the wood "balete" were boiled for ten minutes in a 2 per cent solution of acetic and chromic acid, but were not softened. New pieces of the same wood, boiled fifteen minutes in a 10 per cent solution of the same acids, were not softened. As very little coloring matter was removed by this method, it was discarded.

Boiling "acle" in a 10 per cent solution of nitric acid and chlorate of potassium for fifteen minutes failed to produce the required degree of softness. This method might have produced the desired results, but the extreme care necessary in order to avoid an explosion made it undesirable, especially as another method gave satisfactory results.

At the time these experiments were being made, samples of "tindalo" and "narra"



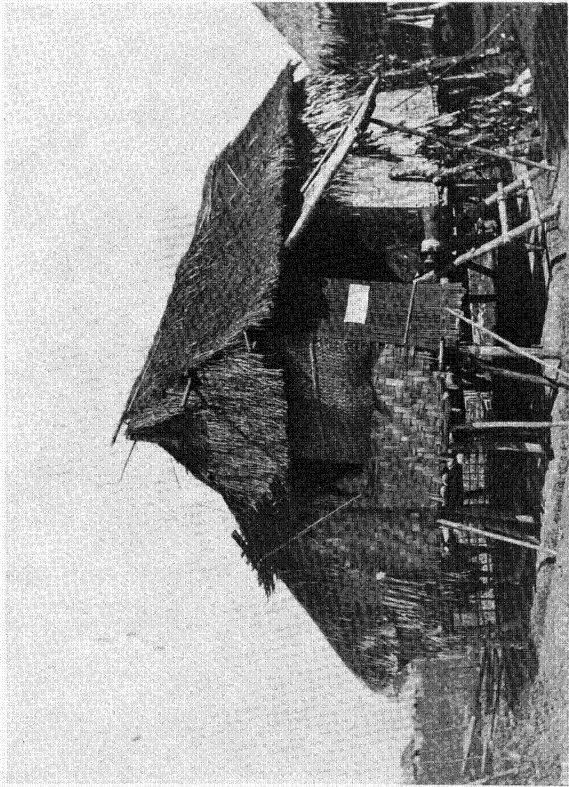
SPIDERS FROM CACAO TREE.



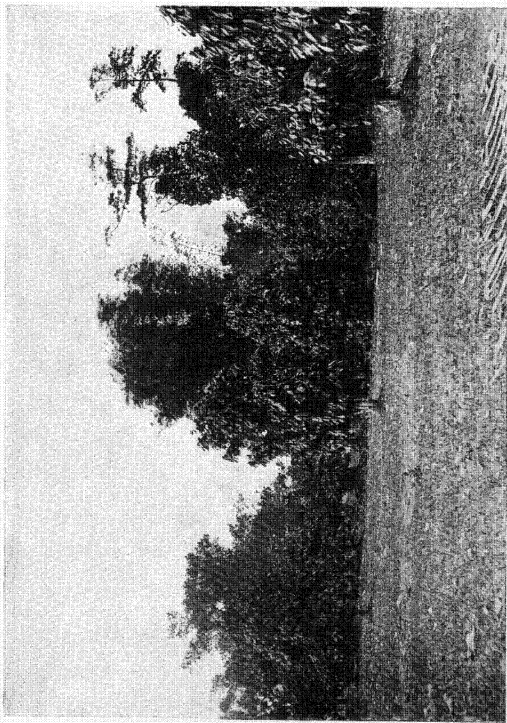
TARANTULA FROM BASE OF CACAO TREE, SHOWING FANGS IN LOWER FIGURE.



CACAO OVERSHADOWED BY BANANAS—GROWTH STUNTED.



TEMPORARY FIELD LABORATORY OF ENTOMOLOGIST NAKALANY MAO, OCCIDENTAL NEGROS.



GENERAL VIEW OF CACAO ORCHARD.



WORKING CACAO ORCHARD, PRIMITIVE METHOD.

were placed in 10, 20, 30, 40, and 50 per cent solutions of hydrate of potassium, corked, and allowed to remain for twenty-four hours. No appreciable softening was noticed, but a great deal of coloring matter had been extracted. The second day showed a slight softening, and this was increased from day to day, the "tindalo" always being softer than the "narra" in corresponding solutions. The degree of softness varied in direct proportion to the strength of the solution, which was from 10 to 50 per cent. In two days the pieces in the 50 per cent solution showed an apparent deterioration of the surfaces. Those in the 10 per cent solution showed but a slight degree of softness. There was but little difference in the other three solutions. In nine days it was almost impossible to detect a difference in the colors of the solutions containing the same kind of wood. The "tindalo" was quite soft in all the solutions excepting the 10 per cent, which was therefore discarded. The 50 per cent solution was likewise dropped on account of the deterioration of the wood, and also of the glass containing the solution.

There being very little difference in the softness of the three remaining specimens, verified by an examination of the "narra," the 20 per cent solution of KOH was adopted as the preferable method for softening wood tissues.

Previously, solutions of 1, 2, and 3 per cent of caustic potash were tried with unsatisfactory results. Possibly a solution somewhere between 10 and 20 per cent would give the best results. At any rate the 20 per cent solution proved satisfactory.

After adopting this method of softening the wood tissues, various samples were placed in test tubes containing a 20 per cent solution of caustic potash, and tightly corked. The latter precaution was taken in order to prevent absorption of moisture from the atmosphere. Only one kind of wood was placed in each receptacle in order to avoid confusion and a possible change in color, but the three different sections of the same piece of wood were placed in the same receptacle. It was thought advisable to treat three samples of each section in order to provide for any accident or emergency that might arise in subsequent operations.

Although the microscope reveals the character of the section, whether cross, parallel to the annular rings, or parallel to the medullary rings, it is much more satisfactory to indicate the difference in the mounted tissues. Each of the three kinds of sections should, therefore, be cut in some distinguishable shape or size before being placed in the softening solution. Two or three millimeters is ample for the thickness of a piece, and the other dimensions need not exceed 1 cm., except for special work.

Some woods were apparently softened in from four to seven days, but later were discarded for others that had been in the softening solution for a longer time. The latter gave much better sections.

The woods requiring from seven to ten days for softening are tindalo, narra (two varieties), supa, ipil, tua, bitanhol, calingag, bolobo, balete, calumpit, sibucac, parua, alintatao, betis, dugonlate, lauan, malibago, apitong, pansainguin, pipipilim, bangat, santol, and pamiasin, which constitute half of the samples treated.

Those requiring from fifteen to eighteen days are panao, guijo, palo maria, agoho, lisong insoc, mambog, camagon, anonag, and anilao.

From eighteen to twenty-four days are required for acle, batino, magalat, yacal, and balaybayan.

Those which were not softened after the last-named period had elapsed were placed in a new solution of caustic potash and boiled under a pressure of 1 atmosphere for three-fourths of an hour with the results that two of the specimens became quite soft, namely, malamhat and molave.

Uayan, alupag amio, tarrieta, aranga, and bolongeta were again placed in the autoclave and boiled under the same pressure for three-fourths of an hour longer, making one and one-half hours in all. At the end of this time they were quite soft.

In two hours ebano was sufficiently softened, when treated in the same way. Macapali and payina are still under treatment, having recently been received.

After the specimens had been softened the caustic potash in the tissues was removed by boiling them in water. From one to two hours was sufficient to accomplish this. Those having a large amount of coloring matter are tindalo, both narra samples, supa, ipil, bitanhol, camagon, calumpit, yacal, sibucac, balaybayan, ebano, tarrieta, aranga, bolongeta, apitong, santol, and pamiasin.

After each specimen had been freed from the KOH, it was dehydrated by passing it through successive baths of alcohol of increasing strength. First 80 per cent alcohol was used for twenty-four hours, then 95 per cent, and finally absolute for the same length of time.

After removing the water, the cells were filled with a supporting material (celloidin) by placing the specimens in alcohol and ether for twenty-four hours, thin celloidin for forty-eight hours, and thick celloidin for the same period.

These tissues were mounted in thick celloidin on wooden blocks and preserved in 80 per cent alcohol. As the tissues cut best when the microtome knife moves in the

direction of the grain of the wood, they were mounted accordingly. A slight distortion in some of the more delicate cells seemed to indicate that a longer time—five to seven days in thin celloidin—would have been preferable to two days. The blocks for mounting were selected from a wood that gave no color to the alcohol.

After a few hours had elapsed the tissues were ready to be sectioned in the microtome. Both the knife and the wood were wetted with 80 per cent alcohol during this operation. The sections varied in thickness from 15 to 30 microns according to the kind of wood, and in all cases were the thinnest obtainable without rupturing the cells. Naturally soft woods gave thinner sections than hard woods, and cross sections were the thickest and most difficult to cut. These were usually about 5 microns thicker than the other sections of the same wood. Until mounted on slides these sections were preserved in 80 per cent alcohol.

Four sets of each kind of section were mounted on slides, two stained and two unstained. The stained sections were prepared by placing them first in water for a few minutes to remove the alcohol, from water to hæmatoxylin stain for five to ten minutes until fully stained, to water again for a few minutes to wash, to acid alcohol for a very short time to remove excess stain, and to water again with a few drops of ammonia until blue color was restored, after which they were dehydrated with 80 per cent, 95 per cent, and absolute alcohol. They were then placed in creosote until clear, removed to slides, blotted, and after an application of balsam, cover glasses put on.

When the sections were not stained the first part of the process was omitted. Beginning with 95 per cent alcohol they were then treated in the same way as the stained sections.

The total number of slides prepared is 170.

Receipts.

[NOTE.—Private work charged for beginning February, 1903; public work from March, 1903, except vaccine, which was charged for from February 4, 1903. Charges for work for insular bureaus ceased July 1, 1903.]

[Mexican currency.]

	Febru- ary.	March.	April.	May.	June.	July.	August.	Grand total.
Private work.....	\$58.00	\$99.00	\$136.45	\$323.50	\$207.20	\$178.30	\$21.00	.....
Board of health.....		2,487.00	2,580.00	1,566.00	2,876.00			.....
Civil hospital.....		664.50	694.00	468.00	656.00			.....
Bilibid prison.....		141.00	54.00	90.00	176.00			.....
Prosecuting attorney.....			150.00		15.00			.....
Exposition board.....			263.00	7.00	126.00			.....
Bureau engineering.....			84.00					.....
I. C. S. and I. P.....			8.00					.....
Constabulary.....			35.00					.....
Philippine Commission.....				21.00				.....
Quarantine service.....				12.00				.....
Bureau public works.....					75.00			.....
Attorney-general.....		10.00						.....
Headquarters Division of Philippines.....				43.00				.....
Benguet Sanitarium.....				6.00				.....
Police department, Manila.....						15.00	9.00	.....
Provisional board of health, Occidental Negros.....							1.00	.....
Total.....	58.00	3,401.50	4,004.45	2,536.50	4,131.20	193.30	31.00	.....
Sale of calves (U. S. currency).....						330.00		.....
	58.00	3,401.50	4,004.45	2,536.50	4,131.20	523.30	31.00	\$14,685.95
Private work (U. S. currency).....			11.00	12.00	26.45	2.60	9.80	.....
Board of health (vac- cine) (U.S.currency).....	2,379.53	1,839.68	3,459.00	1,500.00	738.00			.....
Serum of private par- ties (U.S.currency).....							375.00	.....
Total.....	2,379.53	1,839.68	3,470.00	1,512.00	764.45	2.60	384.80	10,353.06

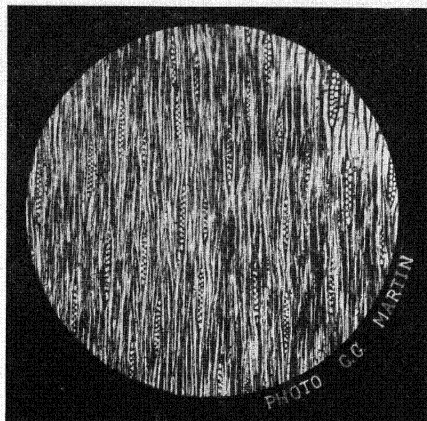


FIG. 204.—TANGENTIAL SECTION OF TINDALO.

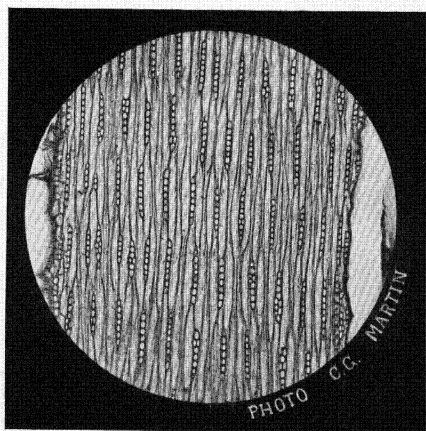


FIG. 205.—TANGENTIAL SECTION OF NARRA.

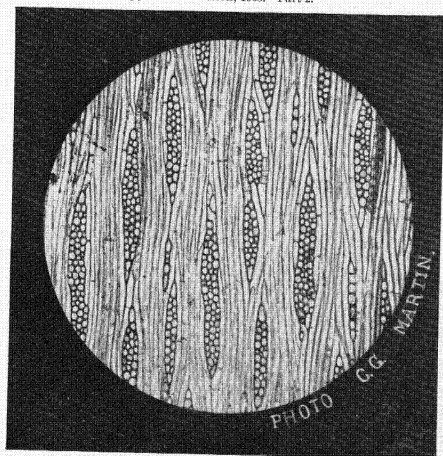


FIG. 206.—TANGENTIAL SECTION OF SUPRA.

APPENDIX H.

ANNUAL REPORT, 1903, OF THE CHIEF OF THE BUREAU OF PUBLIC LANDS TO THE SECRETARY OF THE INTERIOR.

DEPARTMENT OF THE INTERIOR,
BUREAU OF PUBLIC LANDS,
Manila, September 1, 1903.

SIR: I have the honor to make the following report of the operations of this bureau from September 1, 1902, to August 31, 1903, both dates inclusive.

AREA OF PUBLIC DOMAIN.

Frequent inquiries have been made during the past year as to the area of the public domain of the archipelago, and particularly as to the area of its agricultural public lands.

Accurate information on this subject can not be furnished at the present time, because of the lack of a proper system of surveys, and of any trustworthy data among the Spanish land titles in my custody.

Nearly two years ago I made an examination of the writings of a number of Spanish officials who had served in the Philippines, and upon their statements estimated the total area of the islands at about 72,000,000 or 73,000,000 acres.

The only information I have in regard to the area of lands now in private ownership is based upon statements of persons who were born in the islands, and who were employed in the Inspección General de Montes, which office was the predecessor, under the Spanish Government, of the present bureau of forestry. These persons estimated that the area in private ownership did not exceed 12,000,000 acres.

Assuming the correctness of my estimate of 73,000,000 acres for the total area of the islands, that would leave 61,000,000 acres of land belonging to the public domain.

The chief of the bureau of forestry estimates the forest lands on the public domain at about 40,000,000 acres. This would leave an area of 21,000,000 acres of land not forested, the most of which is agricultural in character, and which will be subject to disposal under the law permitting leasing, selling, and homesteading as soon as the act now awaiting the final action of the Commission shall have received the express or implied sanction of Congress.

In the month of June of this year I addressed a letter to the provincial governors asking them for information that would enable me to make an accurate estimate of the areas of their provinces, and the proportionate areas of private and public property, etc. The governors of Cavite, Batangas, Benguet, Ilocos Norte, Nueva Ecija, Paragua, and Sorsogon are the only ones who have up to this date responded to my request. When replies shall have been received from all the provinces the data thus obtained will be tabulated, and ought to form the basis for as accurate an estimate as can be made without extensive surveys.

MINING CLAIMS.

As stated in my annual report of last year, the act of Congress of July 1, 1902, was received in this city only a little over two weeks before the date of that report. As soon as its provisions became generally known throughout the islands, considerable interest was awakened among miners in regard to the location of mining claims, and the necessity for making rules and regulations governing the location and recording of claims was soon felt.

By your verbal instructions given me in the latter part of September, 1902, I drafted such rules and regulations and transmitted them to you on October 3. Various changes having been suggested by persons interested in mining matters and by this bureau, their final adoption by the Commission was delayed until February 7, 1903, when they became law by virtue of act 624. This act was amended on May 29, 1903, by act 777, and on August 27 last by act 859. These three acts of the Commission, in connection with the act of Congress of July 1, 1902, constitute the existing laws in relation to acquiring title to mines on the public domain in the Philippines.

Having had under consideration the matter of further regulations on mining matters, and desiring to know to what extent locations of mining claims had been made under the law as it now stands, on the 2d of last May I wrote to the secretaries of the provinces, who, in accordance with the provisions of section 31 of the act of Congress of July 1, 1902, are now mining recorders, requesting them to make a statement to me showing the names of mining locations presented for record under the above-mentioned act, the name of the locator, the date when the location was alleged to have been made, the date of presentation for record, and whether the claims were placer or lode claims.

All of the secretaries answered this letter, their replies being dated from May 7 to August 26. From these letters it appears that there had been presented for record 357 lode claims, 95 placer claims, 6 coal claims, and 141 claims the character of which was not designated, making a total of 599.

The following tabulated statement shows the number of claims thus reported in each province:

Recorded mining locations.

Province.	Lode claims.	Placer claims.	Coal claims.	Undesignated. ^a	Total.
Abra				2	2
Albay					
Ambos Camarines		1		14	15
Antique	3			2	5
Bataan		b 1			1
Batangas					
Benguet	c 269	16			285
Bohol					
Bulacan	d 16				16
Cagayan					
Capiz					
Cavite					
Cebu		12	2	12	26
Ilocos Norte					
Ilocos Sur		1			1
Iloilo					

^aUnder this head are all claims which have been reported as recorded, but the reports of which did not show whether they were lode, placer, or coal claims.

^bThis is a placer location of a stone quarry.

^cSeventeen of those listed as lode claims are locations for water and mill sites.

^dThese are iron mines.

Recorded mining locations—Continued.

Province.	Lode claims.	Placer claims.	Coal claims.	Undesignated.	Total.
Isabela					
Laguna	2				2
Lepanto-Bontoc				106	106
Leyte					
Masbate	50	10			60
Mindoro			4		4
Misamis		1			1
Moro					
Negros Occidental					
Negros Oriental					
Nueva Ecija		12		5	17
Nueva Viscaya					
Pampanga					
Pangasinan	16				16
Paragua					
Rizal	1				1
Romblon					
Samar					
Sorsogon					
Surigao		a 31			31
Tarlac		b 10			10
Tayabas					
Union					
Zambales					
Total	357	95	6	141	599

^a All gold placers.^b These are oil claims which are taken up under the placer mining law.

DISPOSITION OF PUBLIC LANDS.

The rules and regulations required to be prepared by the government of the islands in accordance with the provisions of section 13 of the act of Congress of July 1, 1902, in regard to the lease, sale, or other disposition of the public lands, were not begun, for lack of experienced assistance, until April. The drafting of an act covering these subjects was completed early in June, and it was transmitted to the Commission for their action after their return from Benguet. The great amount of work devolving on the Commission prevented their consideration of the proposed act until the 17th of August. The act has undergone careful consideration and material amendment at the hands of the Commission, and in its amended form will be submitted to public discussion before its passage and transmission to the President of the United States.

SYSTEM OF SURVEYS.

It had been my intention to recommend in this report the adoption of a detailed plan for placing in operation a system of surveys that should comprise not only a topographical survey of the islands, but also a survey of such lands as might be confirmed to individuals by decrees of the court of land registration, lands patented to natives under the provisions of the latter portion of section 14 of the act of Congress of July 1, 1902, and lands to which rights may be acquired by individuals, corporations, and associations of persons in accordance with the provisions of the proposed public-land act now before the Commission relating to homesteads, sales, and leases.

I have given not a little study to this subject during the past year, and am convinced that the views expressed along general lines in my last annual report were correct. However, it is now not necessary

to discuss the plans which meet my approval, as by resolution of the Commission on the 24th ultimo the matter of recommending a system of surveys was placed in the hands of a committee composed of Judge D. R. Williams, associate judge of the court of land registration; Mr. G. R. Putnam, chief of the coast and geodetic survey; Mr. C. H. Burritt, chief of the mining bureau; Mr. J. W. Beardsley, consulting engineer to the Commission; and myself as the chief of this bureau.

RECORDS OF SPANISH LAND TITLES.

During the past year the number of expedientes relating to Spanish land titles examined and entered on the tabulated lists, the preparation of which was begun during the first year of the existence of the bureau, was only 1,712. The number examined and entered on the lists prior to my last annual report was 8,472, making a total of 10,184 up to date.

The falling off in the amount of work accomplished in this line is principally owing to two causes:

First. The clerks who make up these lists were compelled to give much of their time to making searches for documents called for by private parties and by other bureaus of the government, and also in making certified copies.

Second. The first chief clerk of this bureau, Mr. Gregorio Basa, who at the time the work was begun was the only person in my employ competent to direct it, began to fail in health a few months after the last annual report was made. Because of this he was compelled to absent himself from the office very frequently, and little was accomplished during his absence.

He died on the 22d of May, much to the detriment of the government service, and to the profound regret of all who had been associated with him. Mr. Basa had a more intimate and accurate knowledge of the Spanish legislation regarding the public lands of these islands than any one else whom I have met.

During the year 30 certified copies of expedientes or portions of expedientes of Spanish land titles were issued by the bureau. They aggregated 89,173 words. The fees received on this account amounted to \$66.13, United States currency.

After the death of Mr. Basa two lists prepared by him were found among his papers. These are apparently intended to show the amounts due the Spanish Government because of arrearages in payments on account of sales and composiciones of public lands. It is not known whether these lists represent the results of a complete or only partial examination of the expedientes in the custody of the bureau, and more important work has prevented their comparison with the expedientes. However, the lists apparently show that there was owing to the Spanish Government because of deferred payments for the composiciones of lands 42,735 pesos 90 centimos and 4 octavos, and because of partial payments due on account of lands sold at public auction 78,409 pesos 45 centimos and 6 octavos, making a total of 121,145 pesos 36 centimos and 2 octavos.

These lists, when carefully compared with the documents from which they are supposed to have been made, should prove valuable in connection with the settlement of inchoate claims that may hereafter be presented to the court of land registration or such other tribunal as may be authorized to adjudicate them.

MISCELLANEOUS WORK.

During the year much time has been given to answering the numerous personal inquiries that have been made at the bureau by persons desiring to homestead, buy, or lease government lands, and also in answering letters on these subjects that have been received from many places in the archipelago and from a few in the United States. Most of these inquiries have been made by Americans. The only thing I could do in these cases was to furnish the parties with copies of the act of Congress of July 1, 1902, and call their attention to the fact that the rules and regulations in regard to the lease, sale, and other disposition of the public lands, referred to in section 13, had not yet been enacted by the Commission, and that after their enactment it would be some time before the same could receive the sanction of Congress, or become law through its failure to act.

Similar inquiries, both verbal and written, have been received in regard to mining claims, but in these cases I was able to give more satisfactory information to the persons applying for the same.

From May, 1902, until February, 1903, I had no stenographer, and consequently was much behind in my correspondence, as it was impossible for me to keep up with my work with the small force of clerks I had at that time. In February I got a translator who was also a stenographer, but his time was almost exclusively taken up with translating and interpreting in connection with the work on the San Lazaro estate.

The 1st of April of this year I got two experienced men from the General Land Office in Washington, D. C., and at the same time, by transfer from the insular treasury, a law clerk who was also a stenographer. This help enabled me soon to catch up with delayed correspondence, and to begin the drafting of the public-land act that will be acted on in the near future by the Commission.

The survey of the San Lazaro estate was made by the clerks employed on that work, under the direction of the chief draftsman of the office, who also performed the scientific work connected with the calculation of the area, the checking of the closings, and the making of the map. I have no doubt this was the first accurate survey and reliable map ever made of the Mayhaligue property. This work occupied the greater portion of three months, being interrupted from time to time by current and other necessary work of the office.

During the year I made a map of a proposed town on the island of Culion, where it was intended to establish a colony for lepers. This work did not properly belong to my bureau, but as it was a matter in which the government was deeply interested, I had the work done upon the request of Mr. W. S. Lyon of the bureau of agriculture.

In anticipation of a future need I have had prepared a draft of a manual of instructions to deputy mineral surveyors in regard to the methods to be employed in the execution of surveys of mining claims upon which application shall be made for patent.

A description and plat of the right of way required by the Manila and Dagupan Railway Company for a branch line to Camp Stotsenberg, in Pampanga Province, was received by this bureau on March 20 last. These were examined, found incorrect, and returned to the company several times before being finally sent in fully corrected. This caused not a little work for the bureau, a complete examination and recalculation having to be made upon each return of the papers in the case.

SAN LAZARO ESTATE.

On December 1, 1902, I was appointed administrator of the San Lazaro estate, a property which immediately prior to that time had been administered for the period of sixteen months by Mr. Frank A. Branagan, treasurer of the Philippine Islands.

The San Lazaro estate formerly belonged to the Spanish government and became the property of the United States by virtue of the transfer of sovereignty under the Treaty of Paris.

The proceeds from the renting of the real property belonging to the estate have been devoted to the maintenance of the San Lazaro hospital for lepers.

The estate is the owner of a number of properties in Manila, the most valuable of which is known as the Hacienda de Mayhaligue, situated in the northern part of the Santa Cruz district. Most of the other properties belonging to it are situated in the walled city.

The Mayhaligue property, which is commonly known among the American residents of the city as the San Lazaro estate, contains about 400 acres. At the date of my appointment as administrator the rented portion of this property consisted of about 700 lots, which were in the hands of about 460 tenants, of which number some 400 were acting as landlords for and collecting rents from several thousand families to whom they had sublet the lands.

There was a clause in nearly every lease made with these tenants, and a verbal agreement existing between the government and those who held without formal leases, by the terms of which the subletting of the land was prohibited. This provision had been generally ignored by the tenants, and an investigation showed that the most of those who had violated the clause had thereby been making a profit of from 150 to 200 per cent by subletting the lands. The result was that the sublessees were paying into the pockets of about 400 of the government's tenants thousands of dollars which should have been applied to the maintenance of the San Lazaro Hospital.

As soon as I had familiarized myself with the situation of affairs, I determined to take steps to divert this money from the tenants who were receiving it in violation of their leases, and to see that it was turned into the insular treasury.

Before I relieved Mr. Branagan as administrator of the estate, you had indicated to me the government's desire that this property should be managed not only with a view to increasing its revenue, but also to laying out a modern system of streets, blocks, and lots, to make it a desirable portion of the city for the erection of residences. Therefore, from the very beginning my efforts were directed to the ultimate accomplishment of those objects.

The assessed value of the rentable portion of the Mayhaligue estate in 1902 was somewhat more than \$1,000,000, United States currency. The rents received therefrom during the same period were about $1\frac{1}{2}$ per cent of that amount, or \$12,000. This sum was received from the four hundred and sixty-odd tenants heretofore referred to, the most of whom, in violation of their contracts with the government, were subletting the lands at an advance of from 150 to 200 per cent over the amount they were paying.

After familiarizing myself with the conditions, as far as was possible in a short time, I decided that by renting directly to the sublessees,

instead of to the 400 tenants who had been doing the subletting at twice the proportionate rate which the government had received on each individual lot from its former tenants, the government's revenue would be practically doubled, and that at least 90 per cent of the actual occupants of the lots would be paying less than they were then paying to the sublessors.

Therefore, under date of January 1, 1903, I published a notice requiring all persons owning houses on the property to pay their land rents directly to the administrator of the estate, and prohibiting absolutely any further subrenting of lands, except in the case of those lots containing buildings owned by the lessors. Hundreds of copies of this notice, in English, Spanish, and Tagalog, were distributed among the occupants of the land and every practicable effort was made to bring its contents to the attention of all interested parties.

Very naturally this step did not meet with the approval of the 400 persons who had been exploiting the estate for their own benefit. Their influence in the community was sufficient to stir up considerable opposition to the enforcement of the order, which resulted before the end of January in the presentation of a number of protests to the civil governor. The most important of these protests was made by 27 persons who claimed to have been unjustly treated and seriously prejudiced by my action. A careful examination of the status of these complaints and the grounds of their complaint enabled me to answer their arguments so conclusively that my policy as to the administration of the estate was approved by Governor Taft and the protestants were compelled to pay their rents. That was the end of any concerted opposition to the payment of rents directly to the administrator.

One of the worst features of the former system of subletting was that it had resulted in subdividing the blocks into a large number of lots of irregular shapes and sizes, without any systematic arrangement, the most of which were interior lots having no frontage on any street. The occupants of such lots in order to reach them were compelled to pass over the lots occupied by other persons. This was the cause of frequent disputes and much friction among the lotholders, who were constantly coming to the office with complaints in regard to rights of way.

The only way to remedy this serious and growing evil was to devise a plan for a system of blocks and lots that would give to each tenant a frontage on some street, or an outlet to a street through an alleyway, thus eradicating at once all sources of complaint as to rights of way, removing the chief cause of the unsanitary condition of the district, and at the same time making available for lease every portion of the property at rates that would insure to the government a material and growing augmentation of its rentals.

Preliminary to the establishment of such a system of streets I caused to be made an accurate survey not only of the exterior lines of the blocks situated south of the San Lazaro Hospital, but also of the boundaries of the whole property as nearly as it was possible to identify them from the data obtainable from documents in my own bureau and in the bureau of archives.

An inspection was made of each of these blocks, which resulted in ascertaining the area of each lot and the name of the occupant responsible for the rent. From these data a new rent roll was made up, and the collection of rentals was begun on the new plan of permitting no one to sublet any portion of the estate unless he was the owner of the house constructed on it.

In the mean time a careful study of the actual conditions of the property was made with a view to the formulation of plans for a new system of streets, to cover not only that part of the estate south of the San Lazaro Hospital, but also to be extended over those portions lying east and north thereof, over which portions no streets had been extended.

Before the details of such a system of streets and blocks could be worked out and properly mapped, the most thickly settled portion of the property was devastated by the fire that occurred on the evening of the 19th of May. This fire destroyed practically every building within a district covering about 57 acres. The number of houses lost was probably not less than 1,500, and the number of persons rendered homeless must have reached at least 7,500.

The lines of demarkation between the various lots were absolutely obliterated, and the work of months done by my employees in the inspection of the subdivision of these blocks was completely wiped out in less than two hours. The work of providing for the temporary location of the thousands of homeless persons on the estate was one that taxed the clerks in the bureau to the utmost during the weeks immediately succeeding the fire.

As soon as possible after the fire the work of preparing maps showing the details of the system of streets, blocks, and lots which I proposed to substitute for the antiquated and unsatisfactory system formerly in vogue, was again taken up. On August 24 I submitted to the acting secretary of the interior a lengthy report on the subject, accompanying the same by maps showing the location of the present streets, blocks, and water mains, and the proposed new system which the Commission was asked to approve.

This plan proposed to make all streets at least 20 meters wide. Calle Cervantes alone was to be given a uniform width of 25 meters.

The lots intended for the construction of houses of permanent materials were to be of not less than 20 meters frontage on the streets with a depth of not less than 30 meters back to alleys three meters wide. These lots, if so desired, could be subdivided into four sublots, each 10 by 15 meters in size for the construction of temporary houses of nipa.

The principal advantages of this plan were that there was no lot of the regular size that did not have a frontage on a street; the numerous difficulties that formerly arose with regard to rights of way from the streets to interior lots was entirely removed, for there were no interior lots; the streets were sufficiently wide for the purposes of traffic, and permitted the construction of sidewalks 3 meters wide, except in the case of Calle Cervantes, where it was intended to make them 4 meters in width. The fact that there were no interior lots made all lots that much more desirable, and insured their lease at a figure that would have largely increased the government's revenue therefrom within a few years.

On August 27 the Commission rejected my plan for the improvement of the property, and selected another proposed by the city engineer of Manila.

I had hoped to be able to increase the government's receipts during this year from rentals on this property from \$12,000 to about \$20,000, but the disastrous fire of last May will make it impracticable to do so, as many of the tenants who were behind with their rent lost everything they had, and it is not possible to compel the payment of arrears.

The receipts from rents from December 1, 1902, to August 31, 1903, inclusive, were equivalent to \$9,884.79 United States currency. I do not think that the receipts between now and the 1st of December will reach \$4,000.

Had the Commission seen fit to adopt the plans I had formed for the extension of a new system of streets, I should have expected to be able to increase the revenues from the property within four or five years to at least \$50,000 United States currency per annum.

In the years from 1898 to 1900, two former administrators of this estate, Don Domingo Pacheco, and Vicente Aguirre, made ten leases of portions of the Mayhaligue property to various persons. These leases were made for the period of ten years, in violation of the provisions of section 1548 of the Civil Code, which prohibits an administrator from making a lease for a longer period than six years, unless by special authority.

W. G. Doane, first lieutenant, Thirty-eighth Infantry, U. S. Volunteers, who was administrator of the estate some time before Mr. Branagan, in a special report to the provost-marshal-general of Manila, dated January 31, 1901, recommended that these leases be canceled, and that the lessees, where desirable, be given the opportunity of continuing their respective holdings under new contracts and upon a proper rental basis.

This recommendation was approved on February 7, 1901, by Brig. Gen. J. F. Bell in the following language:

Respectfully returned to Lieut. W. G. Doane, Thirty-eighth Infantry U. S. Volunteers, administrator, San Lazaro Hospital, approving recommendations, which will be executed at once, except in cases of those men who have already paid, who will be notified that their leases will be canceled at the end of the current year.

Under this authority Lieutenant Doane made a readjustment of the rent rate, and most of the holders of the illegal leases paid the increase demanded. Roman Martinez and Mariano Velasco had paid their rent for the year, before the date of General Bell's order; another lessee, Vicente Cenjor, had not paid.

The annual rental due from these three tenants under the ten-year contracts was, respectively, 400 pesos, 151 pesos, and 150 pesos.

In 1902, Mr. Branagan, as administrator, of the estate, tried to collect from these three men, in accordance with a new rate of rental established by Lieutenant Doane on April 1, 1901, the following amounts: From Martinez, \$612.34; from Velasco, \$198.25; from Cenjor, \$198.47, all in United States currency.

They all refused to pay at the new rate, but expressed their willingness to pay according to the terms of their ten-year leases.

These three cases were made the subject of a special report by Mr. Branagan to the attorney-general on January 29, 1902, requesting an opinion as to the legality of the old instruments. On February 1, 1902, the attorney-general stated as his opinion that the contracts "could be rescinded by the government."

On October 21, 22, and 23, 1902, Mr. Branagan, by direction of the civil governor, made detailed reports on these cases to the solicitor-general, requesting that new contracts be drawn up to cover the unexpired term of the original ones, at a yearly rate of rent in accordance with the uniform system established by Lieutenant Doane.

After I was made administrator of the estate I had a number of conversations with Mr. Martinez, who seemed disposed to accept the new

lease that was then being prepared by the solicitor-general, and urged its completion on the ground that he desired to sign it before sailing for Spain, where he expected to visit for a number of months. I had good reason to believe that both Cenjor and Velasco would also sign their new leases as soon as completed.

The drafts of the leases as drawn by Solicitor-General Araneta were the subject of a conference between him, Governor Taft, and me, on the 15th of February.

The next day Mr. Martinez, upon being called in to sign his lease, refused to do so, evidently intending to stand on what he believed to be his rights under the old lease. The day following he sailed for Spain. So far as I know he has not yet returned.

Subsequently I made every proper effort to obtain the signatures of Cenjor and Velasco to their leases, but, after numerous elaborate evasions and excuses, they refused to sign, but made a tender of payment at the rate fixed in the old leases. This I refused to accept. They then deposited the amount offered with a justice of the peace, subject to my order, in accordance with law.

Subsequently suit was brought against these three parties by the solicitor-general, with a view to compelling the payment of back rent and ejecting them from the premises.

In answer to my inquiry as to the status of these suits the attorney-general informed me by letter of July 23, last, that in each of the three suits the defendant had interposed a demurrer to the complaint; that in Cenjor's case the demurrer had not been heard; that in the cases of Martinez and Velasco the demurrers had been heard and overruled, and the defendants required to answer; that no answers had been filed.

If the government should win these suits the moral effect of the victory will be excellent on other tenants that have resorted to every possible means to avoid the payment of their rents.

In addition to the Mayhaligue property the San Lazaro estate holds in the walled city of Manila twelve parcels of land.

In two of these cases the estate owns not only the land but the houses erected thereon.

In the other cases it is claimed by the owners of the houses that the estate has parted with the usufruct of the land, which is perpetually vested in the occupants and their legal representatives, having been acquired from their predecessors in interest to whom the estate conveyed it, conditioned on the payment of an annual ground rent.

The contract that creates this dual estate in realty is known to the Spanish law as *censo enfiteutico*, and apparently is directly derived from the Roman emphyteusis.

There is another lot of land, held by the Jesuit Fathers, at the village of Santa Ana, on the Pasig River a few miles from the city, which is also subject to a censo in favor of the San Lazaro estate.

It is claimed by some of the owners of the houses on the land burdened with these censos that under the Spanish law they have the right to relieve the land of this encumbrance and to acquire the title thereto in fee simple, upon the payment to the San Lazaro estate of a sum of which the annual rental would represent 3 per cent.

The facts in relation to the property at No. 202 Calle Solana are typical of all the properties owned by the estate in the walled city.

This property is under obligation to pay to the estate a ground rent of 38.37 pesos per annum. The assessed value of the land, exclusive

of improvements, is \$6,136 United States currency. The owner of the building on the land rents it as a hotel (Hotel de France) to Maulini & Ferret for 250 pesos a month, or 3,000 pesos per annum.

The aggregate amount of the rentals produced to the estate by the property in the walled city that is held under these censos is 224.36 pesos per annum. The assessed value of these properties amounts to \$30,946.60, United States currency.

The amount received for rent by the owners of the houses on the ten lots in question I am not able to state, but I do not believe that the proportion between the house rent received and the insignificant ground rent paid to the estate in the case of the Hotel de France is any greater than that existing in the cases of the other lots. Assuming this to be true, I should say that the house owners are receiving about 17,000 pesos for house rent, and paying about 224 pesos for ground rent.

It will readily be seen how important it is to the government that the question of the validity of these censos be inquired into, and that if there be legal means of doing it, they be set aside, and the owners of the buildings be compelled to pay a reasonable rental for the use of the lots.

On account of other duties imposed on me, and particularly because of the labors connected with the management of the Mayhaligue property, I have found it impossible to make a proper personal investigation into these titles. However, I hope to be able to do so in the near future, and to make the result of my examination the subject of a special communication.

The rents received from this property are ridiculously small in comparison with the value of the land, and if there be no way of setting aside the censos it would be better that the land be sold, if that can be done legally, provided that the proceeds can be invested at not less than 4 per cent per annum.

I desire to invite your attention to the fact that in order to administer the San Lazaro estate in a proper manner it is necessary that the administrator give to it his undivided attention. No man charged with the performance of other important duties should be asked to handle this property. Mr. Branagan discovered this during the time he had it. The imperative character of the demands made on one's time in order to promptly and justly settle the innumerable controversies arising among several thousand tenants is such as to necessitate great familiarity with the hundreds of irregular lots on the Mayhaligue property, and intimate knowledge of their occupants. Such familiarity and knowledge can not be had without that constant personal attention incompatible with the discharge of other exacting duties.

The management of this property has seriously interfered with other work in my bureau. It has taken up not only the time of the three men constantly engaged on it, but also the time of from one to three other employees, particularly immediately after the fire of last May.

The office for the collection of the rents should be situated on the property itself. This would not only be a great accommodation to the tenants, but a substantial benefit to the government, in that it would enable a daily watch to be kept on the lands and would greatly aid in preventing the settlement thereon of numerous squatters, who, under existing conditions, can and do settle on them, erect houses with-

out permission of the administrator or of the city authorities, and remain there for months before their presence is discovered.

It would be advisable that the administrator of the estate be a lawyer, having a knowledge of Spanish.

In the interests of the government and of the estate I respectfully recommend that I be relieved of its administration in order to give my entire time to the discharge of more important duties, and that some one who can give his undivided attention to the property be appointed in my place.

GENERAL OBSERVATIONS AND SUGGESTIONS.

Section 21 of the act of Congress of July 1, 1902, states in substance that the public mineral lands in the Philippines may be acquired from the government by citizens of the United States or of the islands.

In this connection I desire to invite your attention to the fact that there is no method by which in these islands an alien may become a naturalized citizen of the United States or of the Philippines. Neither can an alien who has taken out his first papers as a naturalized citizen in the United States complete his naturalization here.

Instances have arisen where men of foreign birth, after years of residence in the United States, enlisted in the army during the recent war with Spain and the subsequent war with the insurgents in the Philippines, and, after faithful service and honorable discharge, located mining claims here only to learn, much to their surprise, that owing to their ignorance of the law, and in spite of their good faith, they were not citizens of the United States and consequently could not make a legal location of a mining claim under the existing law.

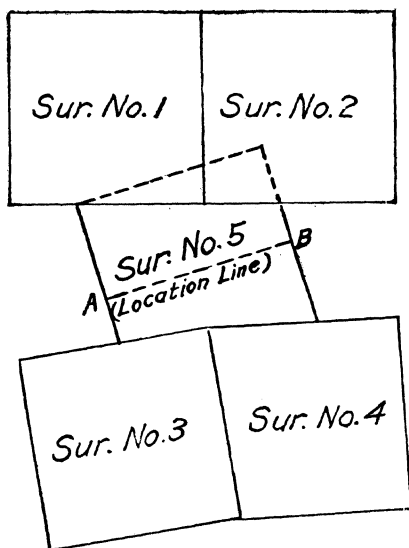
The solution of this problem is doubtless beset with many legal difficulties, but it is desirable to lay it before Congress for its consideration.

An examination of sections 22, 23, 24, 25, 31, and 39 of the act of Congress of July 1, 1902, plainly shows the intention of Congress that lode claims are to be measured by feet and their contents computed in acres, while sections 43, 44, and 48 show that placer claims are to be computed in hectares. Like examination of sections 13, 14, 15, 18, 43, 48, and 53 shows that it was evidently the intention of Congress to apply the metric system to the surveying of the public domain and to the location of coal lands thereon. It would be difficult to give a satisfactory reason for introducing into the land system of the Philippines so anomalous a condition as that caused by the presence of two distinctly different standards of measurement. Possibly it may be explained by the fact that a similar condition exists in the United States with respect to Government surveys, where mining claims are limited in their dimensions to a certain number of feet and their areas computed in acres, while standard parallels, guide meridians, township, and subdivisional lines are measured with Gunter's chain.

I think the attention of Congress should be invited to this inconsistency in the land measurements and that the dimensions of a lode claim should be limited to a certain number of meters instead of feet.

If Congress would amend section 33 of the act of July 1, 1902, so as to remove the limitation as to the number of mineral claims that may be held by any one person, corporation, or association of persons on

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the same lode, then a mineral claim might be limited in size to a rectangle of 300 meters on a side, equivalent to about 984 feet. But if it insists on the present limitation of that section, it should increase the size of the lode claim to a rectangle of 400 meters on a side, equal to about 1,312 feet.

The important thing, however, from the standpoint of the surveyor and draftsman is that all kinds of claims should be surveyed by one standard of measurement.

The advantages of the metric system are too well known to all scientists to need any argument in their support. Surely a country that boasts of the degree of advancement claimed for the United States should not permit itself to be outdone in seeking for scientific accuracy, by a country like Mexico, where the use of the metric system is made compulsory.

I desire to invite your attention to what I think would be a wise amendment of section 26 of the act of Congress of July 1, 1902.

The language of this section is: "That the 'location line' shall govern the direction of one side of the claim, upon which the survey shall be extended according to this act."

The evident object of this section, in connection with the provisions of section 22, is to insure that claims shall have their side lines parallel to the location line and shall preserve a rectangular form, but in section 22 a departure from that form is permitted in cases where a boundary line of a previously surveyed claim is adopted as common to both claims.

Many cases may arise in actual practice in the field where the application of the requirements of section 26 will result in the doing of an unnecessary and useless thing.

Such a case is illustrated by the sketch on the following page.

Here surveys Nos. 1, 2, 3, and 4 represent claims surveyed prior to No. 5. The location line of No. 5 is the line AB (in red ink). Let us assume that the locator of this claim desires his claim to include the full width of the strip between surveys Nos. 1 and 2, and 3 and 4, and that he has no intention of claiming any right to any ground within the lines of those surveys. Now, when the deputy surveyor comes to apply section 26 to this condition of affairs, he sees that the direction of one side of the claim is governed by the "location line," or, in other words, one side must be parallel to the location line. In order to comply with this requirement of the law he must run that line over ground to which the locator of No. 5 makes no claim; he must establish on that ground a corner of No. 5; he must run a portion of one end line over the same ground; he must calculate the area in conflict between No. 5 and Nos. 1 and 2, and the same must be excluded from the patent to No. 5.

I submit that all this is needless and results in no good. The intention to preserve the rectangular character of the claims can be preserved in the law, and the running of unnecessary lines and the establishment of corners within the boundaries of claims belonging to others, can be avoided by the substitution of the following amendment for the present language of section 26:

"That the side lines of the claim shall be parallel to, and the end lines perpendicular to, the location line, excepting such portions of the said side lines or end lines as may be formed by adopting the boundaries of previously surveyed claims."

I respectfully recommend that the above-suggested amendment be submitted to Congress as something worthy of its attention.

I also desire to refer to the provisions of sections 28 and 29 of the act of July 1, 1902, and to sections 12 and 13 of act No. 624, P. C., as touching upon a subject of importance to the locators of mining claims.

These sections all refer to certain circumstances under which mining claims shall not be recorded.

As the recording is now done by the provincial secretaries the reasonable presumption is that they are the persons to decide whether or not those circumstances are present in each individual case that justify a refusal on their part to record the claim in question. The law appears to be very plain as to what these circumstances are. But the fact remains that most of the provincial secretaries are not persons of sufficient knowledge or experience in such matters to justify placing discretionary powers in their hands. They have been reared under a system so basically different from ours that they necessarily regard the discharge of public duties from a different standpoint from that which we occupy.

From what I have seen of the operations of the sections of the acts to which I have referred, I am convinced that it would be wise for Congress and the Commission to so amend the existing law as to leave no discretion with anyone as to the recording of a mining claim. Let the requirements of the law remain as they are, but permit no one to say whether those requirements have been complied with or not, until the claim reaches that point where application is made for an official survey with a view to obtaining title. This is the practice in the United States. It results in throwing the responsibility for error on the proper person—the locator of the claim, and it prevents the improper exercise of either bias or prejudice on the part of the recorder.

I have received official communications from provincial secretaries in the last three months that convince me that nothing should be allowed to prevent the recording of a mining claim except the refusal on the part of the locator or his agent to pay the fees prescribed by law.

APPROPRIATIONS AND EXPENDITURES.

Attached to and following this report is a statement of the appropriations and expenditures of the bureau from September 1, 1902, to August 31, 1903, both dates inclusive.

Act No. 430 covered the first quarter of the fiscal year 1903, and the amounts shown were those pertaining to the month of September, 1902.

Act No. 490 covered the second quarter of the fiscal year 1903. During this quarter the position of chief draftsman of the bureau was provided for. He began work on October 13.

Act No. 595 was made for the second half of the fiscal year 1903 instead of for one quarter. This act provided for the salaries of the two men who were transferred from the treasury bureau when I took charge of the San Lazaro estate. Two clerks of class H and one stenographer of class 9 were also provided for.

The transportation was exclusively for use in connection with the San Lazaro estate. The bureau of public lands has never been furnished with transportation, although it is frequently needed.

The large increase in the contingent fund was to cover the purchase of a transit, drawing tables, drafting instruments, etc., which had to be ordered from the United States. Many of the articles needed have never been received, although requisition was made for them on January 30 of this year.

Act No. 694 was to cover positions made necessary by the reorganization of the office force. No specific sum was appropriated, as it seemed certain that it would not be necessary to fill all the positions provided for during the last half of the year. This appropriation paid the salaries of two men who came from the General Land Office, in Washington, D. C., and one who was transferred from the insular treasury. By this bill two positions of class I were abolished and two of class H substituted therefor. One draftsman, class 8; two clerks, class 8; two clerks, class 9; one draftsman, class G, and two draftsmen, class H, were also provided for.

Act No. 795 was to cover a deficiency caused by the unavoidable necessity of purchasing articles required for the proper transaction of the business of the bureau, the need of which could not be foreseen at the time of making the previous estimates.

Act No. 807 was to cover the expenses of the first half of the fiscal year 1904. The transportation is on account of the San Lazaro estate.

Act No. 870 is to cover the salary of a draftsman who came out from the United States and began work the middle of last month.

It will be observed that the total amount appropriated for the bureau was \$8,136.79 more than was used.

Every reasonable effort has been made to avoid unnecessary expenditures of all kinds.

A year ago I had but 4 employees; to-day I have 13. This increase has been necessitated by a corresponding increase in the work of the bureau.

Very respectfully,

WILL M. TIPTON,
Chief Bureau of Public Lands.

Hon. DEAN C. WORCESTER,
Secretary of the Interior, Manila, P. I.

Statement of appropriations and expenditures for bureau of public lands from September 1, 1902, to August 31, 1903.

	Appropriations.	Expenditures.
Act 430:		
Salaries and wages remaining last report	\$840.90	\$533.34
Contingent expenses remaining last report	15.62	11.53
Total.....	856.52	544.87
Act 490:		
Salaries and wages	2,430.00	2,013.00
Contingent expenses	75.00	34.08
Total.....	2,505.00	2,047.08
Act 595:		
Salaries and wages.....	6,980.00	5,697.29
Transportation.....	364.50	354.60
Contingent expenses ^a	1,102.94	629.83
Total.....	8,447.44	6,681.72
Act 694:		
Salaries and wages, reorganization office.....	(b)	1,454.17
Act 795:		
Contingent expense, deficiency ^c	115.30	.....
Act 807:		
Salaries and wages.....	8,485.00	2,808.33
Transportation.....	364.50	100.00
Contingent expenses.....	591.68	59.16
Total.....	9,441.18	2,967.49
Act 870:		
Salaries	528.90	62.22
Total appropriated.....		21,894.34
Total expended.....		13,757.55
Receipts for certified copies of titles.....		66.13

^a Balance of contingent expense fund retained against order for supplies from United States. Estimated cost of supplies ordered from United States, \$544.75.

^b Sufficient amount to pay salaries created.

^c Applied to balance of contingent expense fund, act 595, for payment of supplies ordered from United States.

APPENDIX I.

REPORT OF THE INSULAR BUREAU OF AGRICULTURE FOR THE YEAR ENDING AUGUST 31, 1903.

MANILA, *September 4, 1903.*

SIR: I have the honor to present herewith my annual report for the year ending August 31, 1903, prepared in compliance with your instructions of June 27, 1903, this being the second annual report of the bureau.

GENERAL PROGRESS OF THE WORK OF THE BUREAU.

The work of the bureau of agriculture, as outlined in my last annual report, has been industriously carried on, with such results as the time and facilities at command would permit, and several new and important lines of investigation have been undertaken. The work in seed and plant introduction and distribution, the soil-survey work, the work of the botanist, and the investigations of the fiber expert into the causes affecting the quality of Manila hemp have been made subjects of publications, bringing these lines of investigation to the attention of the people of the islands and greatly adding to the public interest in the work of the bureau. We have further endeavored to strengthen our work with the general public by liberal distributions of valuable seeds and plants and by gaining a closer insight into the agricultural conditions, through correspondence and visits to important agricultural centers. The experimental work undertaken last year in Batangas Province at Batangas, in Benguet Province at Baguio, and in Zamboanga at San Ramon, has been continued, with results which are given in detail in this report.

NEW LINES OF WORK UNDERTAKEN.

Work was begun early in the year on the trial grounds located in Malate, the land having been secured by purchase for the use of this bureau, and much has been accomplished and valuable information secured through the experiments conducted on these grounds.

A stock farm has been established on the island of Culion, and important work in the breeding of animals and in other lines affecting the live-stock interests of the islands is being undertaken there.

Efforts have been made to establish a government rice farm at Murcia, Tarlac Province, on the line of the Manila and Dagupan Railroad, cultivation to be conducted according to modern methods and with modern machinery. The equipment necessary for this work has been secured and such cultivation carried on as was possible under existing conditions.

The management of the agricultural college and experiment station at La Granja Modela, Western Negros, was, by special act of the Com-

mission, placed under this bureau, and the work necessary to carry out the provisions establishing this college is now being carried on.

The coffee interest, formerly of such paramount importance in Batangas Province, has received attention, and efforts are being made by the bureau to rehabilitate this industry by establishing a coffee plantation at Lipa, formerly the center of coffee production in the province, where correct principles in the care and cultivation of the trees will be practiced.

PERSONNEL.

During the year a number of changes have been made in the office force by appointment or resignation. The most important, as affecting the work of the bureau, are the appointment of an assistant chief, a director of animal industry, a superintendent of the stock farm, and a director of the agricultural college and experiment station in Western Negros; the transfer of the botanist to the bureau of government laboratories; the resignation of the fiber expert, Mr. J. W. Gilmore, whose place has been very ably filled by the appointment of Mr. H. T. Edwards; and the resignation of the soil physicist, Mr. C. W. Dorsey, who had completed the preliminary soil work contemplated under his appointment. It is hoped that some one may be secured at an early date to continue this work.

Officers and employees of the bureau of agriculture on August 31, 1903, with the changes which have been made during the year.

Appointed in Washington.....	3
Appointed on certification by Philippine civil-service board	23
Transferred from other bureaus.....	6
	<hr/> 32
Transferred from bureau.....	3
Resigned	11
Removals.....	6
Deaths	1
	<hr/> 21

Number of employees August 31, 1903.

Executive officers.....	2
Chiefs of divisions, officers in charge of experiment stations, etc.....	11
Clerks, teamsters, etc., American.....	16
Clerks and messengers, native.....	7
Laborers, native.....	169
	<hr/> 29
Total American	29
Total native	176
	<hr/> 205
Grand total.....	205

RECORDS.

The records of the bureau are kept by a card system as simple as the multitudinous subjects handled will admit, care being taken to compile under one subject index all communications pertaining to the same, and consolidating the correspondence from any one source, as far as practicable, under one number.

The needs of the outlying experiment stations are many and various, and the handling and revising of requisitions from them calls for a considerable amount of clerical work.

Constant correspondence is maintained with botanical gardens throughout the world. Communications are daily received and answered touching on all conceivable subjects from information on ground decoration, stock raising, and the cultivation and handling of all kinds of tropical products to the supplying of seeds, hoes, and garden tools.

TRANSLATIONS.

A great deal of time has been consumed in translating into English many articles bearing upon agricultural subjects connected with these islands, and in translating many letters received from our Spanish-speaking correspondents, and also in rendering into Spanish the replies to these letters and the bulletins originally prepared in English. One special piece of work which has occupied an unusual amount of time is that of translating into English a very extended work on agriculture, prepared for this bureau by Señor Emilio A. y Lallave, of Laoag.

CIRCULARS OF INQUIRY.

Many replies have been received during the year to our circular letters of inquiry relative to the agricultural products of the islands and the fiber plants referred to in last year's report, so that now the information at hand upon these subjects practically covers the entire islands. Considerable work has been done in tabulating the information received through these sources and preparing it for publication. An enumeration of Philippine agricultural products, exclusive of fibers, based upon the information furnished by our correspondents, has been prepared for publication (Exhibit A).

Frequent inquiries are received by the bureau relative to the availability and price of lands, the cost of labor, and the principal agricultural products in the different provinces. In order to secure the desired information covering these topics, a circular letter was addressed to officials in the several provinces, containing the necessary inquiries, and very generous response has been received from the parties addressed. The information contained in these replies covers an important field of inquiry of so valuable a character that they are presented in this report. (Exhibit B.)

A number of special inquiries, including the cost of establishing and maintaining a cocoanut plantation, plantations of abacá, rice, and other leading crops, have been addressed to various parties, and all have received prompt and courteous attention. We wish to express here our appreciation and thanks to our many correspondents who have so generously aided us in securing information relative to agricultural matters in their several localities.

PUBLICATIONS.

The publications of the bureau of agriculture are issued in two series: The first, under the general title of farmers' bulletins, contain information compiled from various sources relative to agricultural matters, and are prepared in a popular style for the purpose of diffus-

ing agricultural information; the second series are more technical in their character, and embody the results of experiments and investigations conducted by the bureau. Those published during the year are as follows:

	Copies.
Cacao Culture in the Philippines, by William S. Lyon (English and Spanish), pp. 25, pl. 1, Farmers' Bulletin No. 2	3, 000
Modern Rice Culture, by W. S. Boudreau (English and Spanish), pp. 46, fig. 32, Farmers' Bulletin No. 3	3, 000
Preliminary Report on the Commercial Fibers of the Philippines, by J. W. Gilmore (English and Spanish), pp. 58, pls. 4, Farmers' Bulletin No. 4....	3, 500
Cultivation of Tobacco, by Clarence W. Dorsey (English), pp. 20, fig. 4, Farmers' Bulletin No. 5	2, 000
Ensayos sobre las Enfermedades Fungosas de las Langostas, by L. O. Howard, a Spanish translation by Sixto S. Sandejas of a paper published in the Yearbook of the United States Department of Agriculture, pp. 16, fig. 3, Farmers' Bulletin No. 6	2, 000
Report on the Introduction and Distribution of Seeds and Plants by the Bureau of Agriculture, by William S. Lyon (English), pp. 18, pls. 3, Farmers' Bulletin No. 7	2, 500
The Coconut, by William S. Lyon (English), pp. 33, Farmers' Bulletin No. 8	2, 000
A Report on the Agricultural Soils of Union Province, by Clarence W. Dorsey (English and Spanish), pp. 12, pls. 4, Bulletin No. 1	3, 000
Memoria Preliminar sobre los Terrenos de Abacá de Filipinas, by Clarence W. Dorsey (Spanish), pp. 21, Bulletin No. 2	2, 000
Soil Conditions in the Philippines, by Clarence W. Dorsey (English), pp. 57, pls. 10, maps, 2, Bulletin No. 3	2, 000
Botanical Work in the Philippines, by Clarence W. Dorsey (English), pp. 57, pls. 10, maps 2, Bulletin No. 3	2, 000
Botanical Work in the Philippines, by Elmer D. Merrill (English), pp. 60, Bulletin No. 4	2, 000
Report of the Bureau of Agriculture of the Philippine Islands for the year ending August 1, 1902, reprint from the Report of the Philippine Commission, pp. 661, pls. 9	1, 000

The first editions of Farmers' Bulletins Nos. 1, 2 and 4 are exhausted and new editions of these have been ordered printed.

Our mailing list has increased considerably during the year, and the distribution of these bulletins, of which a complete record is kept, involves no inconsiderable care and time. These duties are performed by a young Filipino in a most satisfactory manner.

SEED AND PLANT INTRODUCTION.

During the year the work of introducing valuable seeds of garden vegetables and important economic plants from the United States, and from reliable sources within the Tropics, and the distribution of these seeds, has been continued. Trial grounds for testing imported seeds and growing nursery stock, requested in my last annual report, have been secured for the use of the bureau, greatly facilitating the work of seed and plant introduction. Experiments already conducted have clearly demonstrated that many garden vegetables of American origin may be grown to perfection in these islands.

DISTRIBUTION OF SEEDS.

Large consignments of seeds have been received from the States and the time and labor involved in arranging these for distribution in uniform allotments, and preparing the necessary instructions, both in Spanish and English, to accompany each package, have been considerable. Nearly 22,000 packages have been distributed, reaching almost every province in the archipelago. There were 137 varieties of Amer-

ican grown field and garden seeds distributed—certainly a generous assortment, which can hardly fail to stimulate interest in procuring a better supply of food products than the native gardens generally afford. From the reports received and from personal observations it is very evident that more particular instructions in regard to methods of cultivation are greatly needed, in order to secure the full benefits from this gratuitous distribution. It is difficult to accomplish this through publications, but through our own experiment stations and with the hearty cooperation of the teachers scattered throughout the islands, the education needed in improved methods of agriculture can be taught by means of object lessons that will make lasting impressions. It is believed that through these means the greatest and most rapid progress can be made.

DISTRIBUTIONS OF SEED RICE.

Large distributions of seed rice have been made by the bureau. This rice was obtained from a reputable firm in Japan, and believed to be of the same variety as that recently imported into the United States, which has given such an impetus to rice culture there on account of its great productiveness. Unfortunately, while the seed appeared to be of first quality, its vitality had been impaired, which will doubtless materially affect the results and lessen the good we had hoped to accomplish. There are very many varieties of native rice, some of which, although grown to a very limited extent at present, appear to be of superior quality and deserving of more extended cultivation. Some of these, because of their superior flavor, greater productiveness, or early maturity, will receive special attention in our future work.

NATIVE FRUITS AND VEGETABLES.

The excellence of many of the native fruits and vegetables, the facility with which they may be grown, and the certainty of yield, justify their exploitation, and much attention has been given to this feature of the work. Lumbang, casuy, ylang-ylang, yam, and varieties of native oranges, lemons, and mangoes have all been planted. It is desired to determine the cost of labor in properly cultivating these fruits and vegetables, and the practical advantages of such treatment.

There are many varieties of native citrus fruits, both oranges and lemons, and some of these are of fairly good quality and command a ready sale in local markets. These fruit trees are easily grown and doubtless the quality of the product can be improved by judicious selection and better culture. Some of them will afford excellent stocks upon which the highly developed and superior oranges of America may be grafted. One of the native lemons appears to be of unusual excellence, the fruit being large and well formed, with thin rind and abundant, well-flavored juice. Batangas Province is noted for its sweet oranges, which find a ready market in Manila. There are growing upon the Manila trial grounds a limited number of Japanese plums, loquats, persimmons, chestnuts, dwarf oranges, and a few pomegranates, which are further mentioned in the report of the superintendent of the grounds.

Introduction of plants yielding oil, essences, fibers, and other economic products has received such attention as time and means would allow. There are many native plants yielding oil-bearing seeds, perfumes, or gums and resins of more or less value. Plants of this class,

while popular with the natives, are rarely cultivated, but they are often of considerable local importance, and the extension of their growth by cultivation might result in supplying a considerable revenue where now poverty exists. Indian corn in several varieties has been cultivated in these islands for many years, and in some provinces it constitutes a staple article of food. Little attention is paid to the cultivation and care of the plants, and the returns are consequently often very light. The varieties grown are all of the flint type, and although the product is sometimes ground and made into coarse meal, which is used for food, the usual manner of utilizing corn is to imperfectly roast the ripened ears and eat the grain from the cob. There is, of course, much waste of food in this way, as the hard kernels can only be imperfectly digested. Nothing is known of the many methods of preparing corn for food practiced in the States, and it is believed that much good will result from the introduction of our southern types of corn, instructing the people how it may best be grown, and the best methods of preparing the product for human food.

COFFEE PLANTATION.

Through the public spirit of Señor Sixto Roxas, of Lipa, a tract of land of about 10 acres has been secured for the use of the bureau for a term of years for the purpose of making experiments in the cultivation of coffee. Señor Roxas has agreed to provide the necessary unskilled labor for carrying on the work, which shall be under the immediate direction of an agent of this bureau familiar with coffee culture. Prior to 1891 there were in Batangas Province extensive coffee plantations, covering thousands of hectares of land, which yielded large incomes to their owners. Since that period the history of these plantations has been but a repetition of that of all coffee-growing countries in the Orient—almost total destruction by attacks of leaf blight and borers. The soil and other conditions of the province are undoubtedly unsurpassed for coffee growing, as evidenced by the product of former years, and it is the purpose of this bureau to secure immunity from disease and insect pests by the selection of vigorous growing varieties and the adoption of the best system of cultivation and treatment.

ACKNOWLEDGMENTS.

To Prof. David G. Fairchild, agricultural explorer of the United States Department of Agriculture, we are indebted for seeds of the finest strains of Sumatra tobacco; to Dr. Jared G. Smith, special agent in charge of the United States experiment station at Honolulu, for approved varieties of sugar cane and for seeds of the alligator pear; to Prof. Henry W. Ridley, of the Botanic Gardens, Singapore, for seeds of *Uncaria gambir*; to Maj. D. W. Prain, of the Royal Botanic Gardens, Calcutta, for seeds of *Indigofera arrecta* and type herbarium specimens of the same, and to Mr. J. C. Harvey, of La Junta, Mexico, for seeds of *Castilleja elastica*.

The introduction and distribution of seeds and plants by the bureau of agriculture is made the subject of a report, published as Farmers' Bulletin No. 7, and a further account of the work carried on by Mr. William S. Lyon, who is in charge of this division, is presented in Exhibit C.

BOTANICAL INVESTIGATIONS.

The botanical investigations of the bureau have been continued along the lines inaugurated last year, and many important results accomplished. There has been so little done on the flora of the Philippines by botanists that there is at first a great deal to do in identifying and classifying the hosts of little known or undetermined species. The systematic botanist has here an almost unexplored field of labor, and while the ground has been broken by Spanish botanists, there remains a rich harvest for the systematist of to-day. It is gratifying to learn that through the aid of private enterprise in the States able botanists will be sent to these islands to study scientifically the native plants and assist us in gaining an exact knowledge of the riches of our flora. In justice to the botanist, Mr. E. D. Merrill, it should be stated that he has been serving as botanist for the bureau of forestry as well as for the bureau of agriculture. In spite of this and the lack of all trained assistance, he has accomplished along several lines an unusual amount of excellent work of more than local interest.

THE HERBARIUM.

Much attention has been devoted to the building up of the herbarium, a most essential adjunct to all botanical investigations, and the collection now contains nearly 6,000 specimens—all, practically, the work of the last year; 4,281 of these specimens are from the Philippines, the remainder being foreign, having been received by donation or exchange. Large numbers of duplicates have been collected and put up into sets for distribution, and 8,561 specimens of these have been distributed to leading botanical institutions in America and Europe. Over 3,000 identifications of plants have been made in the office during the past year, and as the institutions to which the duplicate material has been sent are well equipped with books and named collections, the identifications of our plants will be rapidly made.

Botanical work in these islands in the past forms an interesting chapter in their history, and the botanist has taken great care in searching for all information bearing upon the subject. The results of his researches in this direction are published in Bulletin No. 4, under the title of "Botanical work in the Philippines." This work covers the period from the year 1611 to the present day, giving a brief synopsis of the work accomplished on the Philippine flora by the Spanish botanists, and by those in Europe and America. It includes a brief history of the herbaria and botanical libraries which have existed in Manila, a sketch of the Manila Botanical Garden, the present distribution of Philippine botanical collections in the herbaria of Europe and America, notes on the work accomplished since American occupation, and a bibliography of the books most essential to the botanist working upon our flora. Residents of the islands who are interested in botany will find much in this bulletin to interest them, as it contains a great deal of hitherto unpublished information relative to the history of the science in the past, defines its present status, and suggests that which will be of material aid to future investigators.

FIELD WORK.

Owing to the pressure of office work, field explorations during the year have been very limited. The islands visited where collections

have been made are Apo, a small island in the Mindoro Straits; Busuanga; Culion, where more than three weeks were spent, and Paragua, visited especially for plants yielding gutta-percha, rubber, and damar. The latter substance is the product of a coniferous tree, formed in great abundance when the bark is wounded. It soon hardens upon exposure to the air, and becomes more or less transparent. The best quality of damar is found in the ground about the base of dead trunks, or where trees have stood and long since entirely disappeared. The tree yielding damar is widely distributed in Paragua, there being more or less trade in this product in nearly all the coast towns. From an agricultural standpoint Paragua is of little importance. The island is very rough and mountainous and for the most part covered with dense forests. Botanically, the island is one of extreme interest, as it connects the flora of the central Philippines with that of the northeast of Borneo.

Two weeks were spent in Mindoro during the month of April, for the special purpose of investigating the occurrence of india-rubber plants in that island. India rubber is produced by a vine distributed throughout the island of Mindoro, which is especially abundant in the dry forests of the southern part. The plant is a twining, woody vine, growing to the length of 40 or 50 feet, with a diameter of from one-half to three-fourths of an inch.

There is but little to be said regarding the agriculture of Mindoro for, although this island is one of the richest in natural resources in the archipelago, it is entirely undeveloped. Abacá is grown to some extent along the northern coasts, while cocoanuts are common about the coast towns, being especially abundant at Calapan and Baco. Upland rice is cultivated to some extent, but the production is insufficient for the needs of the people. In southern Mindoro are extensive areas of excellent grazing land. The number of species of plants collected in Mindoro on this trip was 177.

FORAGE SUPPLY OF MANILA.

The botanist has given some attention to the subject of forage supply in the city of Manila. The present sources of supply can be classed as domestic and foreign. The former includes various species of grasses and unhulled rice, or palay, and the latter hay, crushed food, grains, etc., imported from the United States, Australia, and Asia. Like other cities in the East, the chief forage for cattle and horses in Manila is grass, which is cut fresh each day and sold by various local dealers to supply the daily needs of the city. This grass is grown in shallow water, in paddies very similar to those prepared for rice. It is commonly called zacate, and its cultivation in the vicinity of the city is exceedingly profitable. Nowhere in the Philippines is any attempt made to produce hay. This important subject, and the many details connected with its thorough exploration and investigation, are fully presented in the report of the botanist, Exhibit D.

The botanical work is so closely connected with and often essential to agricultural work in almost every line, that the recommendation is here made for the assignment of a botanist to this bureau. It is especially desirable to have some one more or less familiar with tropical products and economic plants.

SOIL INVESTIGATIONS.

In May of the present year the preliminary soil survey work undertaken by the bureau was completed, and Mr. C. W. Dorsey, who had direct charge of this work, returned to Washington, where he has since received an appointment in the United States Department of Agriculture, giving him charge of the soil survey work of the United States and outlying possessions.

During the period of his service Mr. Dorsey accomplished a great deal of very important work, the results of which have been published in Bulletins Nos. 1, 2, and 3 of this bureau. In my first annual report the nature and object of these soil investigations and surveys were fully set forth, and the work which had then been accomplished by Mr. Dorsey in his investigations of abacá soils was also presented. A Spanish translation of this paper was issued later as Bulletin No. 2 of this bureau.

SOILS OF UNION PROVINCE.

The results of a somewhat hasty investigation of the agricultural soils of Union Province form the subject of Bulletin No. 2. This treats of the origin, distribution, and agricultural value of the different classes of soil in the province, together with an account of the principal crops at present cultivated. In addition to the principal crops now grown, rice and tobacco, the soil conditions of Union Province favor the successful introduction of tea and cotton. The coconut industry can be greatly extended along the coastal region, and under a better and more careful system of cultivation the profits from rice and tobacco can be greatly increased. The most valuable farming lands are the rich alluvial soils of the coastal plain region and the large valleys of the interior. These lands should be cultivated to their limit before making any great expenditure of either labor or money to develop the poorer soils of the coast hills or higher mountains farther east. There are large areas which may be devoted to tea culture, and with the abundance of labor available there is a reasonable assurance of success for this industry.

SOILS OF THE FOREST AREAS.

During November, 1902, an inspection tour was made of some of the principal forest areas of the islands, points being visited in Mindoro, Luzon, Masbate, Samar, Leyte, Cebu, Iloilo, Negros, Mindanao, Paragua, and Tawi Tawi. The longest stops were made in Mindoro and Mindanao. Wherever possible soil samples were collected, and the origin, method of formation, and general characteristics of the soils were studied and the agricultural resources noted. The results of this inspection tour form an important and interesting chapter of Bulletin No. 3 of this bureau.

BATANGAS SOILS.

Perhaps the most important work conducted by the soil physicist was the soil survey of a portion of Batangas Province, covering a region which has long been known as one of the foremost agricultural districts in the islands. The actual area surveyed was 290 square miles, at a total cost per square mile of \$1.68. The average cost of this work in the United States to the Department of Agriculture during the past year was \$2.81 per square mile.

In his introduction Mr. Dorsey says that the object of a soil survey is to provide an accurate basis for the adaptation of soils to crops. It seeks to present as clearly and as forcibly as possible the conditions which will enable prospective settlers to take up lands suited to certain crops, and enable present proprietors to learn from the experience gained in other localities what crops are best adapted to their own soils and climatic conditions. The knowledge thus secured may prevent an enormous waste of valuable time and energy in attempting to cultivate crops for which the land and other conditions are entirely unsuited. Eleven distinct varieties of soil were found in the area surveyed, and the exact location and extent of territory covered by each variety is clearly shown upon the colored map accompanying Mr. Dorsey's report, which is published in Bulletin No. 3 of this bureau.

These soils possess varying agricultural value and differ widely in their origin. The alluvial soils which are designated as Calumpang sandy loam and Calumpang loam—the former covering a considerable area of territory—are the most valuable for general farming purposes. Of the residual soils, or those formed by the slow decomposition of the underlying rocks, Lipa loam possesses the greatest natural advantages, while the Telumpoc clay loam, which occupies a considerable area just west of the barrio of Santo Niño and about 8 miles south of Batangas, is the poorest soil in the region.

In the description of the various soils, Mr. Dorsey gives much space to a discussion of the crops suited to each, and in his report he discusses the climate, the physiographic features of the area, and its geology. This soil survey is the first attempted in these islands, and it is believed to be of such practical importance that arrangements for its continuance are urgently recommended.

PLANS FOR CONTINUING SOIL WORK.

Before returning to Washington Mr. Dorsey submitted at my request plans for continuing the work embodied in the following letter:

MANILA, *February 26, 1903.*

SIR:—I have the honor to submit the following plans for the continuation of soil-survey work in the bureau of agriculture. Inasmuch as the greater part of Batangas Province has been surveyed I offer the following suggestions for the further extension of the work.

Large scale maps, 1 inch to the mile, are available for all of the islands of Panay and Marinduque, and in the island of Luzon the provinces of Ilocos Norte and Sur, Union, Pangasinan, Zambales, Nueva Ecija, Tarlac, Pampanga, Bulacan, Bataan, Rizal, Laguna, Cavite, Batangas, and Tayabas have been mapped on the same scale, and these maps will serve very nicely for soil-survey work with some few minor corrections in places.

As a survey has been made in a general farming district, I would suggest that the rice district north of Manila be next taken up. A large section inclosing the area selected for the location of the rice farm would answer very nicely for the southern part of the valley, while a survey of an area in Pangasinan Province will show the distribution of the soils in the northern extension of the valley. After these surveys have been completed I would suggest the sugar, hemp, and tobacco districts.

The country adjoining the experiment farm at La Carlota, in western Negros, will show soil conditions in the finest sugar-producing districts. A survey in Albay Province will furnish a clue to the soils of one of the most important hemp districts, while a survey should be conducted in the Cagayan valley, preferably in the northern part of Isabela Province, to represent the best of the tobacco lands. The coconut industry is prominently developed in Tayabas and Laguna, and good maps in both of these provinces make soil mapping comparatively simple. In all of the sugar, hemp, and tobacco districts above mentioned maps will have to be made, which will increase the cost of the survey.

Blueprint copies of maps of the areas already surveyed can be obtained at the offices of the engineering department on the Malecon drive. One or two copies can be obtained from the lieutenant in charge of maps by stating the purpose for which the maps are used. To obtain large numbers of these maps requisitions will be necessary from someone high in military circles, and such requisitions will be difficult to obtain.

For soil surveying strong native ponies are to be preferred to any other method of transportation. These are so easily cared for and can so readily travel rough country that they far excel American horses or the use of carromatas. McClellan saddles, with saddlebags, enable one to carry soil samples, maps, pencils, etc.

In providing for soil surveys provision should always be made for native guides to explain the work of the soil-survey parties to suspecting natives, and to assist in finding old trails, crossing dangerous rivers, etc.

Respectfully,

CLARENCE W. DORSEY,
Soil Physicist.

Prof. F. LAMSON-SCRIBNER,
Chief Bureau of Agriculture, Manila, P. I.

IMPORTANCE OF SOIL SURVEYS.

That there are 100 persons employed in the Bureau of Soils in the United States Department of Agriculture, 75 of whom have had scientific training, is significant of the importance of the work and the consideration it is receiving in the States. The Secretary of Agriculture in his annual report for 1902 says:

It is believed that the results of the work in showing the conditions and resources of the soils of the country and in giving the people precise and accurate knowledge regarding the possibilities of the soils, justifies fully every expenditure that has been made and every recommendation that will be made for the further extension of the work. With the fierce competition for commercial supremacy now operating, every particle of information bearing upon the natural resources of the country, which will in any way tend to increase the production of our present crops, or to develop new methods, or build up new industries, is of the utmost value.

FIBER INVESTIGATIONS.

There is probably no country in the world producing a greater variety of fiber plants than the Philippines. More than three hundred of these plants are known, and we have reports of many kinds yet unclassified. Some of them are very local in their use; others are more widely distributed and utilized throughout one or more provinces; a few have a wider recognition, while the product of abacá, or Manila hemp, is known the world over and is our most important source of revenue.

Rattans abound here, some of them of superior excellence, suitable to meet all known uses of these plants, and in quantity sufficient to supply all home demands. The natives use them for innumerable purposes, from lashings for heavy timbers of bridges and dwellings to hats and cigarette cases of unsurpassed fineness. Cloths of all weights and textures, from the coarsest sacking to the finest piñas, rivaling in delicacy the silky gossamer of the spider's web, are made from Philippine fiber plants. The investigation and exploitation of this wealth of native products constitute an important feature in the work of this bureau.

BULLETIN ON COMMERCIAL FIBERS.

The "Preliminary report on the commercial fibers of the Philippines," referred to last year, has been published in both Spanish and English. There has been a large demand for this bulletin. It has

been translated into Ilocano by a native of Batad, who was sufficiently impressed with its importance to undertake the work, believing that its distribution among his people would awaken an interest in the subject and develop new industries. Portions of the bulletin have been reprinted in other countries.

INSPECTION OF MANILA HEMP.

In December, 1902, communications were received from the United States Department of Agriculture, stating that commercial houses importing hemp from Manila were making complaints as to its quality, inferior grades being received, and it was feared that, unless some action were taken in the matter, the hemp industry might suffer. Upon the receipt of these communications, the chief of the bureau of agriculture at once directed the fiber expert, Mr. H. T. Edwards, to make a careful and thorough investigation into the causes resulting in the production of fiber of an inferior quality, and the most practicable means of remedying the evil. Investigation was undertaken immediately, and a thorough inspection was made of the leading abacá plantations in several provinces, the larger warehouses where the fiber is baled and stored were visited, and those directly interested in producing and handling the fiber were consulted. The more important qualities determining the value of abacá fiber are strength, color, length, and texture, and an endeavor was made to determine the relative degree to which these qualities are affected by the methods pursued in cultivation, by the processes employed in separation and cleaning, and by the subsequent treatment and handling. A full report upon these investigations, which were conducted during January and February, 1903, was published in Volume I of the Official Gazette, pages 168 and 189. Among the eleven causes which may affect the quality of Manila hemp, enumerated by the fiber expert, the most important are the age and condition of the plant at the time of cutting, the character of the knife used in extracting the fiber, and the condition of the fiber when it is baled—all causes which may be made subject of control. There are a number of varieties of abacá, some maturing earlier than others, and there is also some difference in the quality of the fiber which the several varieties produce; but with proper care and attention, they may all be made to yield a fiber of good color, strength, and texture.

It is in the process of extracting the fiber that the greatest care should be exercised, for its quality depends very largely upon the degree of pressure which holds the knife upon the block and the condition of the edge of the knife itself. If held loosely a great amount of pulp is left on the fiber, resulting in coarseness and dark color. If the edge of the knife be even and the pressure maintained at a suitable degree, a fine fiber will be produced, of good color, strength, and texture. If the edge of the knife be serrated, however—the kind most often used—the resulting fiber will be coarse, badly discolored, and inferior in strength and texture, the degree of inferiority depending upon the fineness or coarseness of the serration of the knife blade. At Gubat, in the province of Sorsogon, Mr. Edwards conducted an experiment to determine the relative merits of the smooth-edged and serrated knives. A detailed account of these experiments and the results secured are presented in Exhibit E.

In connection with the special investigation relative to the production of inferior fiber, a general inspection was made of the hemp industry in the provinces of Albay, Sorsogon, Masbate, Camarines, Samar, Leyte, Cebu, and Iloilo.

Up to the present time no practical machine has been invented for extracting the fiber of abacá, and the work continues to be done by the laborious and slow method of drawing the strips of the plant containing the fiber between the blade of a knife or bolo held firmly upon a block of wood. The invention of a really practical machine for doing this work would revolutionize the hemp industry in these islands and would add greatly to this source of income.

COST AND INCOME FROM ABACÁ PRODUCTION.

Owing to the importance of the hemp industry, many inquiries have been received by the bureau relative to the expenses involved in establishing an abacá plantation, or "late," as it is called, and the following letter from Governor Betts, of Albay Province, written in compliance with my request, is of interest in this connection:

GOVERNMENT OF THE PROVINCE OF ALBAY,
OFFICE OF THE GOVERNOR,
Albay, P. I., August 24, 1903.

SIR: I have the honor to acknowledge receipt of your esteemed communication of the 18th instant, in which you make inquiries concerning the cultivation of hemp, or abacá.

The information herewith furnished is such as I have been able to secure from several of the largest as well as the oldest growers of hemp in this province. Replying to your questions:

1. The cost of land varies according to its proximity to the market and the availability of transportation. The former price of public lands ranged from 3 to 8 pesos per hectare; the present price of land in possession of private owners, suitable for the cultivation of hemp, but now planted in other products, varies from 15 to 50 pesos per hectare.

2. The cost of preparing the land will average as follows: Virgin forest land, 30 pesos per hectare. This formerly cost about 18 pesos; the price of labor at present being almost double what it formerly was. Land under cultivation with other products costs about 15 pesos per hectare to prepare.

3. The cost of hemp seed of first-class hemp will average about 1 peso per thousand. The cost of young plants, or suckers, 10 pesos per thousand.

4. In virgin territory hemp is planted about 3 meters apart; on old territory—that is, land having formerly been used and now replanted—about 2 meters. Old territory gives much better results than new.

5. The cost of maintaining a hemp plantation until the first cutting, is very small. It should be weeded at least twice each year. On many old plantations they clean them twice in three years. The average cost of cleaning varies from 7 to 10 pesos per hectare.

6. The number of cuttings per year varies in the different "lates;" some owners cut twice a year, others once every eight months. Large "late" owners find the cutting once every eight months gives much better results and a much longer fiber. The average hacienda gives almost a continuous supply; by the time the workmen have passed from one end of the "late" to the other, the product is again ready for reaping at the starting point. There are no seasons, but the product can be reaped throughout the year. The average "late" will give on the average of 7 piculs of hemp each time it is harvested, although some "lates" run as high as 10 piculs at each cutting. "Lates" on hillsides give the best results and the greatest product per acre.

7. Marketing facilities: These vary largely as to the location of the hacienda. As a rule, "late" owners are not required to carry their product any great distance to market; most of the exporting houses have their agents distributed throughout the hemp territory, collecting the hemp, where it is assembled and sent to the seaport towns for pressing. There are a great many small tiendas, run by Chinese, distributed promiscuously throughout the mountains, which buy any little or great amount, usually exchanging merchandise for the hemp.

In addition to the above questions, it may be of some interest to you to know the experience of some of the older and important producers as to the length of time required for producing hemp from the seed and from small suckers, or shoots; also, the difference in time of producing these on new and old territory.

Virgin territory requires about thirty months for the first cutting; old territory, about three years and a half, when planted with the suckers. Seed requires about five years.

Hemp produced from the seed is always of an inferior quality, the fiber being very weak and the plant full of sap. I find that "late" owners, when they plant from seed, as soon as the plant is about 4 feet high cut it down, as though they were intending to harvest the same; they then take out the root, or bulb, and cut off the lower third of the bulb and replant it; this gives a very large, firm plant, with long and exceedingly strong fiber. Why this is true I do not know; but owners tell me they have found this out by experience. Many owners wait until the end of five years, when they take the first cutting from the seed plants and harvest the cutting and then treat the bulb as stated above.

Mountainous or rolling land is far preferable for the hemp. Hemp grown on hill-sides or mountain sides is always superior to that grown in the plain or on the top of the mountain. Virgin soil that is covered with large, heavy forest trees produces, as a rule, very superior hemp.

This office will always be pleased to furnish you any information it possibly can. Trusting the above is the information you desire, I remain,

Very truly, yours,

A. U. BETTS, *Governor.*

HON. F. LANSON-SCRIBNER,

Chief of the Bureau of Agriculture, Manila, P. I.

MAGUEY OR SISAL HEMP.

Maguey, or sisal hemp, imported many years ago from Mexico, is reported from a number of provinces in Luzon, and forms an article of considerable commercial importance in Ilocos Norte. In speaking of maguey, Señor Policarpo Soriano, of Laoag, says, in a communication to this office, that maguey is usually found in abandoned rice fields. In many cases the plants form the dividing line between estates, and occasionally constitute quite an important object of cultivation. Maguey does well in any soil, but undoubtedly yields better results in those which are slightly moist. Cultivation consists of making a small hole in the ground during the rainy season, into which a bulb of the plant is placed. These bulbs will show signs of life within a few days. The plants are then allowed to grow for two years, or until such time as the leaves have attained sufficient development to yield fiber. In extracting the fiber the leaves are cut from the plants and then divided several times lengthwise and thrown into water, either salt or fresh, where they are allowed to macerate for from eight to ten or more days, according to temperature. After maceration, the fiber is cleaned by washing and allowed to dry in the sun. Maguey fiber is usually about 1 meter in length, and the price per picul varies, according to quality, from \$8 to \$15 Mexican. Eight hundred to a thousand plants may be grown upon a hectare of land, which will yield a crop of from 5 to 10 piculs of fiber. The cultivation of maguey should be encouraged in every way possible. It will grow in regions entirely unsuited to abacá and upon soils which would otherwise be of little value.

In 1900 the United States imported 76,921 tons of sisal hemp, valued at \$11,782,263, and the demand for this product is constantly increasing. The opportunities here for meeting a portion at least of this demand by extending our maguey plantations and importing suitable machinery for extracting the fiber are unusually good, and should receive the attention of the agriculturists who are interested in the development of the islands.

EXPERIMENT STATION IN MALATE.

In my last annual report I urged the importance of securing a tract of land in or near Manila for the purpose of making experiments with new and untried seeds of plants which might be introduced, and for affording a suitable place for conducting experimental work under the immediate supervision of the bureau. After carefully looking over the various tracts of land in and about Manila, a selection was finally made of a tract in Malate, a subdivision of the city of Manila, and within a mile from the present bureau.

STATION GROUNDS.

By authority of the Commission the necessary steps were taken for the purchase of this land, embracing 48,309 square meters, or about 12 acres, and work was begun upon it on October 22, 1902. A street, Calle San Andres, divides the tract into two unequal portions, about 4 acres lying upon the south side of the street, the larger portion being upon the north side. The soil is a light, sandy loam, easily worked, resting upon a sandy subsoil, affording ready drainage. There were two wells upon the place, but these proved inadequate for proper irrigation and one of them has been enlarged in order to increase the water supply. A water tower has been built and the necessary pumping and distributing outfits installed for the purpose of irrigating during the dry season. There was practically no rainfall from the time work was begun upon the place until July 1 of the present year, and what irrigation the growing crops received was applied by hand. The crops grown during this period and the results secured are given in detail in the report of the superintendent of the station (Exhibit F).

INSECTS.

Insect pests were more or less abundant and were the cause of failure in the growth of a number of crops. The vegetables which were grown successfully during this period—all from American seed—were the following: Tomatoes, onions, lettuce, radishes, lima beans, string beans, eggplant, peppers, okra, sweet corn, pease, sweet potatoes, and beets. During the same period successful results were obtained with jute, sesamum, velvet beans, teosinte, rubber trees, and coffee.

FORAGE.

The question of forage supply, especially in the vicinity of Manila, is an exceedingly important one, and the steps taken by the bureau in introducing forage plants which can be successfully grown here, to alleviate present conditions, are of special interest. At the Malate Experiment Station marked success has been obtained in growing teosinte, one of the most valuable and most productive forage plants known. In general appearance teosinte resembles Indian corn, with which it is closely related botanically; but, unlike corn, it produces many shoots from a single seed. Thirty or forty, or even more, shoots have been counted growing from a single grain. In this respect teosinte is like oats, and it is for this reason that it is so exceedingly productive in yield. A small plot of teosinte, planted on January 6, gave five cuttings between March 21 and August 10, the growth at the last cutting being nearly 6 feet high and yielding at the rate of 16 tons

of green fodder per acre. The total yield of green feed for this plot during the period specified was at the rate of $49\frac{1}{2}$ tons per acre. Two acres of teosinte were planted on June 6. Owing to the dry weather this did not germinate until about June 20. An area of one-tenth of an acre of this planting was cut on August 10 and yielded at the rate of a little over 17 tons to the acre. Five days later another tenth of an acre was cut from the same planting and yielded at the rate of $26\frac{1}{2}$ tons to the acre. The crop is being sold green at the rate of \$10 gold per ton, the contract price paid here for zacate.

On well-fertilized ground and properly managed, we may reasonably expect teosinte to yield during the year, under several cuttings, at least 100 tons of fodder. Our experiments so far would indicate a larger yield than this. With a ready market close at hand, it is needless to say that there are few crops which will give greater returns than teosinte. Teosinte matures its seed, and produces an abundant crop here, and our first experiment at seed production yielded at the rate of 800 pounds of thoroughly cleaned seed per acre. This yield was secured during the dry season. Two and probably three crops of seed can be grown on the same ground during the year, which, at the same rate for each crop and at prevailing prices for the seed, would mean a return for seed alone of \$1,440 gold per acre. Experiments with teosinte were made by the Spaniards some years ago, and the following is an extract from a report^a of these experiments made in Manila:

Average yield of forage.—The quantity of fertilizer to be applied, and whether or not the soil requires a lime dressing, are important factors governing the yield of this forage. In all cases the yield of the first cutting is greatest, successive cuttings diminishing uniformly, though not greatly.

From experiments we have made the best results were obtained in tracts of land to which had been applied stable manure at the rate of 10 kilograms to the square meter, as well as in tracts fertilized upon the same ratio, with the addition of a lime dressing of 5 deciliters per square meter.

The average results obtained from all cuttings were as follows:

Land manured, but not limed: Two and one-half kilograms of forage per square meter, or 25,000 kilograms per hectare (607.50 arrobas per balita).

Land manured and limed: Three kilograms of forage per square meter, or 30,000 kilograms per hectare (729 arrobas per balita).

If the teosinte has been planted by the middle of December, and it be ready for cutting by the end of January, and cuttings may be made thereafter every twenty-five days, and if the rainy season set in during the last fortnight of June, under these conditions seven cuttings will have been yielded by the end of that month, and the total yield in land manured and limed will be 21 kilograms of forage per square meter, or 210,000 kilograms per hectare, or 5,103 arrobas per balita, or a trifle over 187,044 pounds per acre.

SESAMUM.

Sesamum has been grown with great success, both during the dry and rainy seasons. The seeds of this plant are valuable for the oil they furnish, which finds a ready market. The gross value of our seed crop, secured during the dry season, was estimated at \$19.80 gold per acre. Three crops can probably be grown on the same land during the year.

TOBACCO.

The experiments with tobacco grown from Sumatra seed gave most satisfactory results. The total yield from two crops was at the rate of 1,470 pounds to the acre. A greater yield would probably have resulted

^a Boletín Oficial Agrícola de Filipinas, No. 2, February 28, 1894.

from earlier planting. The seed was sown on January 14 and transplanted to the plat one month later, at which time there was little or no moisture in the ground. On May 7 the first cutting was made. The tobacco was cut and handled in the same manner as practiced in tobacco-growing districts in the States. On July 7 the tobacco was stripped and graded, 14-inch leaves being graded as No. 1; 12-inch leaves as No. 2, and the short leaves and trash as No. 3. Both Nos. 1 and 2 will make fine wrappers. The leaves were exceedingly thin, very elastic, of a good light color and silky luster, having every appearance of first-grade wrappers. The burning quality of this tobacco has not been tested, but it is claimed by growers here that tobaccos grown near the seacoast are deficient in this quality. We have seen some very superior tobacco from the Cagayan Valley grown under shade. The difference in quality between the shade grown and that of the same variety grown in the open only a few feet away was most marked. The leaves of that grown in the open were coarse-veined, rough to the touch, and comparatively thick; while that grown in the shade had very delicate veins, was very thin and elastic, with a fine, silky luster. The great superiority of the shade-grown tobacco was clearly demonstrated in this case.

The following letter relative to the cost of tobacco production in the islands, from Señor Benito Reynaldo, of Carlatan, Union Province, will interest those contemplating tobacco raising here:

UNION PROVINCE, LUZON,
Carlatan, August 25, 1903.

DEAR SIR: I have the honor to acknowledge the receipt of your esteemed favor of the 20th instant, to which (after thanking you for the opinion you have formed of my humble self, your servant) I proceed to reply with the greatest possible accuracy and in the order of your interrogatories:

1. Cost of tobacco land per hectare: As the producing power is not the same in all lands nor in all pueblos, nor even in those devoted to the cultivation of this crop, and as prices have increased here during the last few years, it is impossible to state a fixed price, but calculations may be based upon \$150 Mexican for the poorest to \$250 Mexican for the better classes per hectare.

2. Cost of preparing the soil and planting tobacco: Notwithstanding that the ground for this planting requires two or three thorough plowings, which will leave it clean of all weeds and almost pulverized, still, in provinces where a few people own large tracts of land, working it for their own account, the proprietor generally rents his land to one or more laborers, taking into account that a family, composed on an average of wife, husband, and three children, can take care of 6,000 to 8,000 "matas" (about 25 areas). This family will plant, care for, cure, and even make the "manos" (small bunches of leaves, formerly containing 100), and then divide the product, one-third going to the proprietor, and sometimes as much as one-half, which is the maximum. I believe the product could be divided as follows: One-third for the proprietor, another third for expenses of cleaning and sowing the tobacco, and the remaining third also for the grower, to pay for the growing of the tobacco, construction of the shed for curing, and preparation of the "manos." Therefore, supposing that in a hectare there be planted (at 1 vara apart) 24,000 plants, the yield in land of average quality, and allowing for loss of leaves, will be 7 quintals per 1,000 plants, or a total of 168 quintals. At \$7 per quintal, this would amount to \$1,176, making the third divisions equal \$392, one of which thirds could be utilized in defraying expenses of nursery and cleaning of the land, as stated above.

3 and 4. Cost of cultivation and harvesting and curing tobacco: Given the preceding calculation, and if all farm work be performed by the farmer and his family, the result will be that another third, or \$392, may be applied upon the work called for in these two queries.

5. Gross yield of the land: The remaining third.

NOTE.—As you will see, I make no deduction for accidents or loss of crop, which may be brought about by many causes, such as drought at the beginning of transplanting, excess of moisture during development, or baguios, of so frequent occurrence in these regions.

6. Facilities for sale of tobacco in the province: This company, having warehouses in all of the pueblos and points of shipment, besides having Chinese as well as Philippine merchants in all these places devoted to the trade, planters may obtain the best price for their tobacco.

7. The causes of loss of part or all of the crop are: Excessive drought when setting out the nursery or when transplanting; early torrential rains which flood the lands and cause the plants to rot; and various terrestrial and atmospheric phenomena, which destroy their delicate roots or overthrow the plants.

It affords me great pleasure to give you these data, which conform as nearly as may be to the interrogatory with which you have honored me, and begging that you will excuse any errors you may find in the same, I take this occasion to place myself at your disposal whenever I may be of service to you.

Respectfully,

BENITO REYNALDO.

The CHIEF OF THE BUREAU OF AGRICULTURE,
Manila.

The experiments which are being conducted on the Malate grounds will prove of great interest, and the value of the station to the bureau, in testing new importations, can hardly be overestimated.

SAN RAMON.

Work on the Government farm at San Ramon near Zamboanga has been continued during the year, by Mr. Havice, the superintendent in charge. The effects of the unprecedented drought which has prevailed throughout the islands during the past season were felt at San Ramon, and the abacá plants suffered severely, many dying on account of the dry weather. The trees in the cacao orchard, referred to in my last annual report, have all died—probably due to neglect during the period intervening between the Spanish and American régimes. The storeroom and tool house begun last year has been completed; also a barn, 30 by 60 feet; an office 20 by 30 feet, and several houses for natives. A number of bridges have been built and such attention and care have been given to the cocoanut and abacá plantations as the means and facilities at command would permit.

It is urgently recommended that steps be taken to extend the cultivation of cocoanuts on the San Ramon farm, and provide the superintendent with sufficient additional laborers, farming tools, and draft animals necessary to prepare the ground and plant 200,000 cocoanut trees. In from seven to ten years such a plantation ought to yield more than \$200,000 Mexican per year in value of copra alone. In the meantime, income can be secured from abacá, for which there is suitable land on the place. The present expenses and income from the San Ramon farm are shown in Mr. Havice's report. (Exhibit G.)

In connection with the cost of establishing a cocoanut plantation, and the probable income which this crop may be expected to yield, the following letter from Señor G. Unson, provincial secretary of Tayabas is of interest, although directly applying to the provinces of Tayabas and Laguna:

TAYABAS PROVINCE, LUZON,
Lucena, August 4, 1903.

SIR: I have the honor to acknowledge the receipt of your favor of July 31, and take pleasure in giving you, as extensively and minutely as lies in my power, information regarding the cultivation of cocoanuts, from the preparation of the soil to the conversion of the fruit into copra, and the expenses incident thereto.

METHOD OF PREPARING A COCOANUT PLANTATION.

The following method has been employed in the provinces of Tayabas and Laguna: Directly after the land has been selected the ground is broken, which is done dur-

ing the months of January and February, having been cleared previously of all forest growth. In April, when thoroughly dry, and just before the first rainfall, all branches, leaves, and stubble should be burned carefully. The trunks and large branches (the remains of this burning) should be heaped up in piles and burned to ashes. By this means the ground will have become absolutely cleaned. After the first rains of April and May have fallen holes are made in the ground from 7 to 9 varas equidistant, according to locality, and in the province of Tayabas to a depth of 7 to 9 inches, and 16 to 17 inches in Laguna Province.

COCOANUT NURSERY.

One year, or at least six months, previously, a good variety of nuts should be selected (preferably fruit of matured trees 15 or 20 years old), securing the largest and most nearly round obtainable, fully ripe, with the shell dry, gray, and speckled with black. They are generally gathered during the rainy season to avoid the inner shell becoming hard. These nuts are placed in moist ground under shade. At the expiration of one year they will have attained a height of 1 meter, or half a meter in six months. They should then be transplanted, care being taken to cut the very well grown roots before placing them in the holes previously prepared. The planting effected, the ground is once more cleaned of weeds, which grow with extreme rapidity at the first fall of rain. In the month of July following upland rice should be planted, as this will prevent the growth of noxious weeds up to harvesting time, at the close of October or during November.

This upland rice harvested (a course which it would be wise for the farmer to pursue), sweet potatoes, arrowroot, corn, mangoes, peanuts, etc., should be planted which can be harvested by March or April of the following year. During the month of July the ground is once more cleaned of bushes and weeds that may have grown to a height of a meter or more, and upland rice is again planted, to be harvested in November. This crop, however, will be weaker than that of the preceding year. However, it furnishes another source of income for the planter, and besides serves to keep clean the land which is planted in cocoanuts, while these are of an age when they require the greatest care in order to avoid their being choked with weeds or bushes, which would retard their growth. Generally, after the second harvest they are allowed to develop by themselves, the ground being cleaned once or twice a year until the fruiting period, which is when the trees have reached the age of 7 years, counting from the year in which they were planted.

PLANTATION OF 5,000 COCOANUT TREES.

An area of 20 hectares is required to plant 5,000 cocoanut trees at 9 varas equidistant. The families of ten tenants will be able to cultivate this area, 2 hectares being apportioned to each family, upon which space will be planted 500 trees in one year (from prepared seeds). At the expiration of seven years the proprietor, having his 5,000 trees, will credit his associate tenants with 50 cents for each of half the number of trees as their share—that is, the sum of \$1,250 for 2,500 trees, the two crops of rice, as well as the cereals and tubers obtained, having also been apportioned to them. Fencing, care of the plantation, and maintenance of the ten families are all for account of the tenants. Should the soil require tillage, five carabaos will be necessary on a plantation of 5,000 trees. One-third of the crop of upland rice is paid in compensation for the use of the animals. The crop in dry seasons usually yields tenfold. Total expense to the proprietor, \$1,250 for 5,000 trees, besides the cost of the five carabaos. Cost of the land varies between \$10 and \$50 Mexican per hectare.

INCOME FROM A PLANTATION OF 5,000 COCOANUT TREES.

Upon soils of first quality, such as the banks of the sea or of rivers subject to great overflows, by means of which much sea mud is deposited, each tree will yield 15 nuts in one harvesting, which can be gathered every two months—that is, 15 nuts can be gathered six times a year, making the annual yield of a single tree amount to 90 nuts; 5,000 trees planted in first-quality soil will yield at the full fruiting period (from the time they are 15 years old) an annual crop of 450,000 nuts; in second-class soil 300,000; and in third-class soil 150,000. Sold at \$20 Mexican per thousand, which is the current price, the fruit of first-quality soil would yield a revenue of \$9,000 Mexican; that of second quality \$6,000 Mexican; and that of third quality \$3,000 Mexican. In the province of Laguna, where the nuts themselves are sold, one-quarter or one-fifth is deducted as the tenant's share; in Tayabas one-third is apportioned to him.

METHOD OF PREPARING COPRA.

In Laguna there are industrials who devote their attention to converting cocoanuts into copra upon a large scale. In Tayabas every proprietor has upon his plan-

tation a tapahan, a drying oven, or as many as the extent of his plantation may require, and the method of preparation is as follows: A pit is dug 2 varas in width by 4 in length by 2 in depth; a shed is constructed, the roof consisting of dry cocoanut palms, to protect the pit and the surrounding space against the rains, and about 1 vara from the ground is constructed a kind of flooring, of the exact dimensions of the pit. Three sides are covered with a cloth called sala. The fuel is deposited through the side remaining uncovered. This fuel consists of the fibrous husk (coir) and the very hard, woody husk (chireta) of the cocoanut, and falls to the bottom of the pit. The outer fibrous husk of the nut is cracked by means of a plowshare upon a pole embedded in the earth. Three or four dextrous blows will leave the cocoanut with only the hard, woody husk, which is halved crosswise with a blow of a bolo. After the nuts have been opened and the water removed, they are placed upon the cane flooring over the pit in rows of ten or twelve, the coverings uppermost, care being taken to see that the fire is maintained at a good heat with the fuel above mentioned, though the flames should not be allowed to burn either the copra or the shed. At the expiration of two or three hours the rows are changed—that is, those at the bottom, which are half cooked, are placed on top until the meat is in condition to be separated from the hard husk, and this operation is repeated continuously until the batch is finished. For removing the meat an iron implement is used, in the shape of a spoon, fixed in a wooden handle. When the meat is separated it is placed upon what may be called a grate, to complete the drying. The operation is completed when the meat can be separated with the fingers; and when it is lead colored it is called copra.

In the province of Tayabas a single oven can dry 1,000 or 2,000 nuts daily. The industrials of Laguna manufacture these ovens of much larger dimensions, and the grate, as well as the cane flooring, are upon a level with the ground, closer to the fire. These ovens will dry 10,000 to 15,000 nuts daily. In Tayabas the manufacture of copra is for account of the tenant, one-third of the amount realized from the sale of the article being apportioned to him as his share. Transportation in the interior is always expensive, and is effected on the backs of animals, the copra having been placed in sacks. A horse can carry about 200 pounds for a distance of 7 miles; a carabao 2 piculs. The animals are for account of the proprietor.

One thousand cocoanuts in Laguna yield $3\frac{1}{2}$ piculs; in Tayabas 4 to $4\frac{1}{2}$ piculs; and in some barrios, such as are supposed to be the result of volcanic deposits in ancient times, the yield is from 5 to $5\frac{1}{2}$ piculs. So that the 450,000 cocoanuts grown in soil of the first quality, converted into copra, at 4 piculs per thousand, will give an annual yield of 1,800 piculs; second quality 1,200 piculs; and third quality 600 piculs.

IMPROVEMENTS INTRODUCED IN THE CULTIVATION OF COCOANUTS.

Some planters, desirous of securing the earliest possible production, say, in half the time (seven years) required at present, have experimented by planting at greater depth; some at 1 vara, others at half a vara, and all agree that more space should be allowed to remain between trees—say 10 varas. When working animals were plenty, many proprietors, it is said, succeeded in forcing fructification in five years, by plowing at the side of the trunks once a year. They agree also that early fructification depends upon maintaining the plantation clean and free from bushes and undergrowth. It is not absolutely known whether a large yield is due to planting at a depth of 6 to 7 inches (in this province the roots are completely stripped of bark to a height of 20 to 25 inches), or whether this injures the tree and makes the fruit scarce, as there are no trees planted at greater depth by means of which production by these two methods could be compared. The bureau of agriculture, having a wider field of observation among the various producing provinces, all differing in methods of planting—as, for instance, in Laguna plantings are made at twice the depth at which they are effected in Tayabas—may be able to solve this problem for the planters.

The method pursued in making copra is in urgent need of change.

In Laguna Province a short sickle is utilized for gathering the fruit, an entire bunch being cut down with one stroke, while in Tayabas a blunt iron cylindrical hook is used, with which the nuts are gathered singly. The writer has succeeded, before the semiannual presidential assembly, in convincing the presidentes that the short sickle used in Laguna should be employed here. With this implement an expert can gather from 3,000 to 4,000 nuts in a day.

The decorticator at present used is also very primitive, and requires much strength and time. But that which calls most urgently for improvement is the oven, and for the following reasons: Because of the poor quality of copra produced; because it is a smokehouse rather than an oven; because the meat of the cocoanut absorbs the smoke from the fibrous husk, ill-smelling in itself; because the smoke turns it to a

dirty gray; because much time is wasted in changing the location of the nuts without satisfactory results being obtained; because part of the copra is well roasted and part remains almost raw, though externally they present the same aspect.

Before these ovens were used, the halved nuts were dried in the sun, and when the meat appeared to be in condition to be separated from the chireta, it was removed with an iron spoon-shaped implement and once more exposed to the sun for complete drying. The resulting copra was white and beautiful, the odor agreeable, and the oil sweet. This method has been abandoned, because there is not always a good sun, and also because it entails greater labor. The field ovens used by the military for baking bread, modified to meet the requirements of copra, ought, I believe, to give good results. It is expected that American industrials may perfect an apparatus which will dry the greatest number of nuts within the briefest possible space of time.

If a field or portable oven, with a capacity of 2,000 nuts per day, could be had for not to exceed \$40 or \$50, Mexican—within the reach of the small proprietors of Tayabas Province, where a plantation of 1,000 trees requires three poorly made ovens, and where, of necessity, the nuts must be dried upon the plantation—thousands of these ovens could be placed within a short time. It should be noted that the proprietors of Tayabas Province do not attempt to improve their ovens as long as the work of copra making is done by the tenant. But they would be convinced of the advantages of a well-made oven: First, because of the good quality of copra that would result and the consequent higher price it would command; second by, the tenants would expend less time and labor in the manufacture of copra, and, therefore, the two-thirds constituting the proprietor's present share would be converted into three-quarters of the product.

Very respectfully,

G. UNSON,
Provincial Secretary.

Mr. F. LAMSON-SCRIBNER,
Chief, Bureau of Agriculture, Manila.

BATANGAS EXPERIMENT STATION.

The experiment station in Batangas, started last year under the direction of Gen. Franklin J. Bell, has been carried on by employees of this bureau, and on June 30, 1903, the land, together with the improvements thereon and a paid-up lease for the land for five years from February 1, 1903, were turned over to this bureau by Capt. D. H. Boughton, treasurer of the "war and emergency rice fund." This station contains 25 acres, and lies between Batangas City and the bay, a small portion bordering the Calumpang River. The soil is a sandy loam, easily worked, the water level being from 6 to 8 feet below the surface.

The work has been placed in the charge of Mr. J. H. Shipley, who has remained constantly at his post and has given eminent satisfaction. There are upon the land a dwelling house and office, occupied by the superintendent and foreman; a stable for the draft animals; and an 80-foot windmill with a capacity of 3,000 gallons per hour, for irrigation. These buildings were built by Captain Boughton, and the two mules now on the place were furnished by him. Mr. Shipley has employed only native laborers, who have given general satisfaction. Ten laborers are regularly employed. The principal object of the work in Batangas is to demonstrate the practicability of using American machinery, and the growing of forage plants, such as alfalfa and teosinte, and certain other staple crops, such as cotton, sugar cane, etc., according to American methods. Experiments have been made in growing American vegetables, but, owing to the limited period during which this work has been conducted, there is much yet to be learned, especially with regard to the best time for planting seeds of the different varieties. Mr. Shipley reports that, when properly cultivated, the following may be regarded as sure crops at all seasons: Lettuce, beets,

egg plant, endive, salsify, peppers, onions, okra, and carrots. Further tests are necessary to determine the best or proper period for planting other crops. The keeping down of weeds in the experimental plots involves a great deal of labor, and much care has to be exercised in keeping the plants free from insect pests. All small garden seeds have to be planted in boxes, raised upon tables, in order to keep the red ants from carrying them off. The plants grown in this way have all to be transplanted by hand, which is a tedious and expensive process. Mr. Shipley reports, August 29, that the alfalfa is 5 inches high and prospects fair; that the receipts for July and August were \$70.30 and disbursements \$63.90. (Exhibit H.)

EXPERIMENTS AT BAGUIO.

The experiments in growing American vegetables and field crops at Baguio, made last year, have been repeated under more favorable conditions, the plantings being made earlier and the ground more thoroughly and carefully prepared. The result, however, was practically the same—almost total failure. A great variety of seeds were experimented with (see Exhibit I), and their early development gave promise of success, only to lead to disappointment when the plants reached that stage where they had to depend entirely upon the elements drawn from the soil for their nutrition. The general opinion of those who have tried American vegetables in the locality is that the climate is too cold and the soil poor. The soil has the appearance, however, of being of excellent character, and is covered with a dense growth of grasses and other native plants. It has been suggested that the cause of failure was due to a low soil temperature. The nights are cool and the soil does not warm up during the day as it does at lower elevations. It has also been suggested that the trouble with the soil is that it contains a large number of coarse grass roots, rendering it too open and porous to properly nourish young, tender plants. This condition is sometimes observed in the States with freshly turned prairie sod. If this be the real trouble it will certainly disappear with a year's cultivation and rotting of the turf. Samples of the soil were submitted to the Bureau of Government Laboratories for chemical analysis with the request that substances likely to be injurious to plant growth be looked for and determined. The following is a copy of the analysis presented:

	Sample number.	
	1417.	1418.
Total organic matter.....	19.52	20.45
Total alkalies ($K_2O + Na_2O$).....	6.19	7.37
K_2O (soluble in acid).....	.98	.86
CaO.....	.23	.21
P_2O_5.....	.08	.08

The average amount of soda, as obtained by subtracting the average of potash from the total alkalies, shows the enormous amount of 5.86 per cent. It was requested that the forms in which the sodium occurs be determined, and whether chlorides and carbonates of soda occurred, either of which, in any considerable quantity, would be fatal to most plants. Replying to this request, it is stated that the total amount of alkali in the two samples of Benguet soil probably exists in the form of silicates with some chlorides and a trace of carbonates.

The information furnished by this analysis is insufficient for the drawing of any conclusions with regard to the soil, or to suggest remedies. With more complete chemical data and further observation and experiments in the handling of the land, it is very probable that efforts to grow crops at Baguio will eventually prove successful. Several varieties of vegetables are now being grown in Manila, in soil from Baguio, and they have every appearance of a well-nourished growth.

In the meantime, experimental work has been transferred to Trinidad, $4\frac{1}{2}$ miles distant from Baguio and about 500 feet lower in elevation. The work of establishing an experiment station at this point is now well under way; the land has been fenced and a house built for the accommodation of the superintendent, Mr. Thomas Hanley, who is in charge. (See Exhibit I.)

AGRICULTURAL COLLEGE AND EXPERIMENT STATION AT LA CARLOTA, WESTERN NEGROS.

La Granja Modela, near La Carlota, western Negros, referred to in my last report, was, by act No. 512, approved November 10, 1902, placed under the bureau of agriculture. The purpose of the act was to enable this bureau to establish in western Negros an agricultural college and experiment station, modeled, so far as circumstances and local conditions would permit, after similar institutions in the United States. The law provides that the director of the institution shall be appointed by the civil governor, with the advice and consent of the Commission, and that the subordinate officers and instructors or employees of the college and experiment station which may be authorized, shall be appointed by the chief of the bureau of agriculture, subject to the approval of the civil governor. Provision is made for establishing courses of instruction and conducting experiments necessary for the thorough organization and working of both college and station. Fifteen thousand dollars were appropriated for beginning improvements on the farm, and a director was appointed on March 25 to assume direct charge of operations. The work so far accomplished has been chiefly confined to the building of roads and improvement of certain portions of the land preparatory to beginning experiments. (Exhibit J.) Plans have been prepared for a main building in which will be combined laboratories, class rooms, offices, and dormitories for the pupils, and \$25,000 has been appropriated for its construction. Owing to the difficulties in securing suitable lumber for the construction of such buildings, it is recommended that it be built of brick, for the making of which there is an abundance of suitable material on the place.

ANIMAL INDUSTRY.

During the year important steps have been taken toward organizing the work in animal industry. A director of this branch of the bureau has been appointed, and a stock farm has been established and placed under an efficient manager. The director, Dr. Harry H. Dell, was appointed through the United States Civil Service Commission, and arrived in Manila on March 27, 1903. Thus far Dr. Dell has been unable to take up any definite line of work, owing to the necessity for his frequent detail to conduct operations in the provinces in immunizing arobao from rinderpest, work which is under the direction of the board of health. (Exhibit K.)

STOCK FARM.

The improvement of existing breeds of domestic animals by careful selection, or by the importation of improved stock from other countries, comes within the special province of this bureau.

A properly equipped stock farm is necessary for carrying on this line of work, and on October 15, 1902, the Philippine Commission authorized the chief of the bureau of agriculture to take steps toward the establishment of a stock farm, in accordance with his recommendation, the total outlay for the purchase of animals, their transportation and maintenance, and payment of salaries and wages, not to exceed \$20,000 for the year ending June 30, 1903. Steps were at once taken to secure a suitable location for the farm, and on October 22, 1902, Mr. A. J. Washburne, who had been appointed to conduct the preliminary work, was directed to visit the government farm at Magalang with the view of determining whether that location would be suitable for our purposes. He reported adversely upon the locality, and was at once directed to visit Benguet with the same object in view. After inspecting the region about Baguio and La Trinidad, Mr. Washburne reported that in the valley of La Trinidad he found land well located for a model stock farm, and all conditions apparently favorable, excepting that of climate. Further, he considered it impracticable at that time to take valuable animals over the trail from San Fernando.

As it was desired to secure a location entirely free from animal diseases, attention was directed to the island of Culion and, after a brief survey of conditions there during the month of December, the chief of the bureau of agriculture was directed to establish, under the supervision of the secretary of the interior, a stock farm on the island of Culion, and to select a site therefor and take the necessary steps for carrying out the project of such a farm.

In company with Mr. Washburne, the chief of the bureau of agriculture visited Culion, taking with him the necessary equipment and supplies for beginning work.

The island of Culion lies just south of the island of Busuanga, in the northeastern part of the province of Paragua. We landed on the morning of January 13, 1903, and located camp near the southeastern extremity of Halsey Harbor. A large, well-watered valley opens up at this point, affording excellent grazing, and apparently well suited in all respects for a stock farm. There are probably about 5,000 acres of open country in this valley, extending $2\frac{1}{2}$ to 3 miles east and west, and of about the same breadth north and south. There are high mountains on the north and south, and the eastern border forms a low divide, overlooking the straits between Culion and the island of Coron. It is limited on the east by Halsey Harbor. There are streams entering the valley from the southern, eastern, and northern slopes, and although the water sinks in these—through the dry season, at least—there is an ample supply of stock water near the foot of the mountains, and where the streams empty into the bay.

The principal grasses belong to the *Andropogonae*, or broom sage tribe, the most abundant and most valuable being a species of *Helionorus*, which grows to the height of 3 or 4 feet and has a decidedly blue stem. Cattle and horses both appear to be fond of this grass and are in excellent condition while grazing upon it. Certain areas of this blue stem are now being cut with a mowing machine, with the view of determining its value when dry, and supplying hay when needed.

Three samples of soil from the Culion stock farm have been analyzed by the bureau of government laboratories, and two of them show content of lime and phosphoric acid much below what good grass soils in other parts of the world contain; they are, in fact, only about as rich in these important elements as the sandy loam cotton soils of Georgia or the Carolinas, which have to be fertilized. The other sample of soil indicates much greater fertility in phosphoric acid. The potash, which is another important item in determining the fertility of these soils, was estimated along with the soda, and, as soda is unimportant as plant food, this part of the analysis is valueless.

There is ample timber for building purposes on the mountain slopes about the valley. There is an unlimited supply of nipa available, and bejuco (rattan) in several varieties is found among the timber. The land is of such a character that a four-wheeled wagon could be drawn without difficulty from the landing in Halsey Harbor to the extreme eastern end of the valley, and over the well-beaten trail between these two points one could run a bicycle with ease.

In my communication to the honorable secretary of the interior of February 9, 1903, I unhesitatingly recommended that the stock farm be located in the valley above described. During the three weeks of January that I remained on Culion every part of the valley in question was explored and the streams emptying into it thoroughly investigated. There is an abundance of wild game in the valley, including deer and hogs.

The site for the buildings was located near the eastern end of the valley, upon the banks of a creek that heads near the foot of Maus Mountain. This point is near the landing, with a large stretch of open country gently sloping to the north.

Thirty laborers, under a native foreman, were secured from the force employed in establishing a leper colony on another part of the island, and work of construction was at once commenced. For the most part the laborers have been procured from Cuyo, and are paid 2 pesetas a day and food. All necessary supplies, including 6 mules, have been furnished from Manila. The coast-guard steamer, with headquarters in Manila, visits Halsey Harbor twice every month.

On April 9 Mr. Washburne was detailed to accompany the insular purchasing agent to make investigations preliminary to purchasing carabaos for importation and distribution in these islands. Mr. Zalmón K. Miller, expert in farm machinery and management, was at once directed to go to Culion, and serve as acting manager of the stock farm during Mr. Washburne's absence. Seventy calves, turned over to this bureau from the Serum Institute, 3 American brood mares, 2 Australian mares, 16 native mares, and 1 Arabian stallion, have been sent to the stock farm from Manila, and Mr. Miller reports that all of these animals are now in excellent condition, as are also the 6 mules above referred to.

During the past season a well 58 feet deep has been dug near the house, and it now contains 45 feet of water. One house, 25 by 60 feet, with a broad porch on one side and extensions for bathroom and kitchen on the other, has been built of native timbers and nipa. There has also been built a house of three rooms for the foreman, and a bunk house, 24 by 50 feet, for the native laborers; also a barn or stable, 24 by 132 feet, and about 4,000 feet of fencing has been put up.

On December 1, 1902, requisition was made for 2 American stallions

(1 electioneer and 1 director or dictator), 2 jacks, 3 Jersey bulls, 5 Jersey cows, 2 Chester white boars, 2 Berkshire boars, 24 milk goats from Malta or Naples, and a number of varieties of fowls. On April 21, 1903, requisition was made for 10 Sind breed of cattle from Karachi, Sind, India (2 bulls and 8 cows), 10 Surti milk buffalo from Gujarat, India, and for 8 Holstein cattle from Java, including 2 bulls and 6 cows. On the arrival of these animals it is believed that the work on the stock farm will assume the importance which its object merits.

IMPORTS AND EXPORTS.

The following statement in regard to the importation and exportation of cattle, meats, and animal products for the fiscal year ending June 30, 1903, has been kindly furnished this bureau by the collector of customs:

	Quantity.	Value.
Imported during the fiscal year ending June 30, 1903:		
Cattle.....number..	28,963	\$707,015
Horses.....do.....	523	27,050
Mules.....do.....	77	9,322
Hogs.....do.....	446	3,667
Sheep.....do.....	421	2,252
Carabao.....do.....	288	7,581
Fresh beef.....pounds..	998,166	82,155
Fresh pork.....do.....	38,026	5,728
Fresh mutton.....do.....	60,874	4,614
Imported for insular and United States governments:		
Horses.....number..	69	.....
Mules.....do.....	86	.....
Fresh pork.....pounds..	50,000	.....
Exported during the fiscal year ending June 30, 1903:		
Animals.....number..	5	330
Animal products.....pounds..	56,586	8,383

RICE FARMS.

Rice is the staple article of food for the Filipinos, who each day consume 10,500,000 pounds, or 5,250 tons. This estimate is based on an allowance of two pounds of rice per day for 5,250,000 people out of seven millions estimated population. The islands do not produce this amount of rice, and large quantities are imported each year from Saigon and other Asiatic countries to supply the demand. It is safe to say that if the great extent of territory in these islands suitable for rice culture were utilized for growing this produce and more modern methods of cultivation practiced, instead of importing the large amounts now brought into the country, there would be not only enough to supply all the wants of the islands, but leave a grand surplus for exportation, bringing millions of dollars into the islands which are now sent abroad for this one item alone.

With the view to encouraging more extended rice cultivation and to demonstrating the practicability of growing rice in these islands by the methods practiced in the United States, the Philippine Commission enacted a bill on February 11, 1903 (Act No. 634), authorizing the establishment of a government rice farm not to exceed 2,000 acres, and making an appropriation from insular funds for its equipment and maintenance. Prior to this time, in October, 1902, the question of establishing a government rice farm upon a large scale was taken under consideration by the Commission, and estimates of the cost of such a scheme and the probable income which might be derived from the plantation, should the work prove successful, were submitted by this

bureau to the secretary of the interior. It was decided to locate the site at some point along the line of the Manila and Dagupan Railroad, where the necessary facilities for transportation were available, and a number of places were visited by Mr. W. J. Boudreau, expert in charge of rice culture, for the purpose of selecting land suitable for the plantation. A tract of land lying between San Fernando and Bacolor, in the province of Pampanga, was finally selected as the one best suited for the purposes in view, and after a full explanation of the intentions of the government, the owners of the land were willing to rent to the government the entire tract (about 2,000 acres), receiving therefor one-fourth of the crop. This arrangement, which was made about November 12, 1902, was held open for some time; but when final action was taken on February 11, 1903, authorizing the chief of the bureau of agriculture to rent the land, a number of the owners had already commenced to prepare the ground for crops, and although some time was spent in endeavors to secure the land then, they were unavailing. It was therefore necessary to go over the ground again in search of a suitable location, and it was nearly the middle of March before the present site, which appeared to be the only land available at all suitable for the purpose, was secured. The season was so far advanced at this time that it was imperative that the work of preparing the land for seed should be immediately undertaken, and Mr. Boudreau at once commenced operations with the necessary force and such implements as could be secured. Such articles and machinery as could not be procured in the markets of Manila were ordered from the States. Owing to unforeseen conditions it was deemed unwise to attempt to carry out the plans originally proposed on the land selected, and it was necessary to considerably limit the extent of the cultivations. Mr. Boudreau has earnestly endeavored to carry out the work intrusted to him, and while it is yet too early to pronounce upon results, the progress, made under most trying conditions, has been all that could be expected.

In his report Mr. Boudreau says:

Certain facts have been established which at one time were problematical. It has been proved that American mules can be worked as successfully in the fields of the Philippine Islands as in those of the Gulf States. The mules on the rice farm, although not first-class animals and therefore more liable to attacks from surra and other tropical diseases, are in better condition to-day than they were when they arrived. These mules have been worked nearly every day from the 20th of April through May, June, and July—the hottest season of the year—and beyond sore shoulders and one mild case of distemper no sickness has appeared among them. All that appears to be necessary to keep them in good condition are shelter, wholesome food, and clean water.

The one serious drawback to the substitution of mules for carabaos in this country at present is the relatively high cost of forage as compared to the value of Philippine farm products. The maintenance of a mule on imported forage is, financially, a serious matter, and as he is destined to play an important part in the agriculture of these islands every measure should be taken by the Government to hasten the day of his general adoption.

At present the question of forage is the most serious one. With cheap forage the day would soon come when the carabao would be relegated to obscure barrios where transportation does not exist.

It would be reasonable to suppose that mules could thrive on the same ration here as is given them in the States of Alabama, Mississippi, and Louisiana. In these States corn and cowpeas constitute the bulk of a mule's feed. These two crops can be grown more cheaply than any other forage crop in the South, and for this reason very little oats and timothy are sown. In certain localities grassy rice and red immature rice are cut for hay just previous to the blooming period, and this makes a very fine forage.

Corn does well in this country and cowpeas are likely to succeed. There is grow-

ing on the rice farm about a half acre of cowpeas, seeded June 20, and to-day (July 22) they are beginning to run, and look very thrifty. Upland rice, which can be grown as economically as oats, and gives a heavier yield, makes a superior hay. These three crops alone would be sufficient to constitute a complete feeding ration, and I believe that next year it would be well for the Government to undertake to raise at least a part of the forage for the use of the farm.

This year's work has also demonstrated that American mules and American agricultural implements can be handled by the Filipino if a certain amount of supervision is exercised over him. It does not take him long to appreciate the merits of our implements, and if his purchasing power were equal to his appreciation, and if some energetic Americans would take the trouble to show the Filipino landowner that the carabao has no objection to dragging an American plow or harrow, the Philippines would soon be in a prosperous condition.

In conclusion I would respectfully suggest that steps be taken at once to secure a more suitable location for the farm. It will take a considerable length of time to secure a tract of land which will be in every way suitable and at the same time available. The questions of transportation, drainage, irrigation, and topography have to be considered. Furthermore, the land should belong to only one or two proprietors instead of to many, and should be out of cultivation.

After the tract has been located, a thorough survey should be made, and the question of natural or artificial irrigation and cost thereof will have to be considered. Other preliminary work which would take time would be the clearing of the land and the construction of buildings. All of this should be concluded before farming operations begin, because after plowing has begun there is no time to attend to anything else.

BAT GUANO.

Large deposits of bat guano are found on several of the islands, generally in caves. With the view of determining its manurial value samples of the guano have been submitted to the bureau of government laboratories for analysis. A sample from Guimaras Island showed a very low content of nitrogen, the fertilizing element giving to guanos generally their chief value. It contained a fairly large percentage of phosphoric acid and a small percentage of potash. Rating nitrogen at 15 cents a pound, phosphoric acid at 5 cents, and potash at 5 cents, this guano has a fertilizing value of about \$12.50 a ton. It would not, therefore, bear transportation as an export, but would be valuable, no doubt, for use in the islands, and especially in the neighborhood where located. Its value would be enhanced if mixed with cocoanut cake, candlenut cake, cotton seed, or even with other guanos rich in nitrogen.

A sample from Mindoro, which was analyzed, contained per ton of 2,000 pounds about 140 pounds of nitrogen, at 15 cents, \$21; 8 pounds of phosphoric acid, at 5 cents, 40 cents; and 15 pounds of potash, at 5 cents, 75 cents; or a total value of \$22.15 per ton.

This guano shows by analysis to be nearly equal to cotton-seed meal in value. Mixed with the guano from Guimaras a well-balanced fertilizer would result.

EXPOSITION AT ST. LOUIS.

In a country so essentially agricultural in its industries as the Philippines the exhibit of the agricultural resources and products of the islands must constitute a very considerable part of their display at the World's Fair in St. Louis. The field is a broad one and includes a great variety of subjects, from the implements used in preparing and tilling the soil to the finished products affording food or raiment.

WORK OF THE BUREAU.

Several members of the bureau staff have spent a good deal of time in collecting, preparing, and classifying material for the exposition,

and temporary helpers have also been engaged in this work. A great deal of interesting material has been secured through these means, but the force thus employed would have been unable to make an adequate exhibit without the cooperation of the different provincial committees who have interested themselves in the enterprise. Some of the provinces have devoted a great deal of energy and care in the preparation of their agricultural exhibits, making them very complete and especially interesting.

In the so-called permanent exposition, which was opened in Manila on February 23, 1903, the bureau of agriculture took an active part and made a display of considerable extent and importance, especially in the line of fresh fruits and vegetables. The fiber expert is still in the field gathering material for the fiber exhibit, and Mr. Charles L. Hall, who has been at work collecting for the bureau in the provinces of Bulacan, Tarlac, Pangasinan, etc., rendering very efficient service, is at the present time collecting in the province of Bataan.

The fiber exhibit will include collections of the different varieties of rattan and the many classes of Philippine fibers, together with the various fabrics and other products made from them and the tools and implements used in their manufacture. The material for the general exhibit consists of all kinds of farm machinery and agricultural implements used in cultivating the land, in caring for the crops, and in the preparation of products for the market, fruits and vegetables and food products of all kinds, and photographs of such things as can not well be presented otherwise. The horticulturist has secured a large number of stands of cycads and tree ferns, which it is hoped will serve a useful purpose in decorating the grounds assigned to the Philippines. The botanist has spent a good deal of time in classifying the material that has been sent in, and is preparing for the exhibit an herbarium of economic plants.

PUBLICATIONS RECEIVED.

The following journals and periodicals are received by subscription:

Indian Gardening and Planting.
Bulletin de la Chambre de Commerce de
Saigon (exchange).
The American Florist.
The Tropical Agriculturist.
California Fruit Grower.
The Gardener's Chronicle.
Agricultural News (Barbados).
American Gardening.
El Hacendado Mexicano.
The Chemist and Druggist.
The Scientific American.
Revue des Cultures Coloniales.
The Queensland Agricultural Journal.
The Agricultural Gazette of New South
Wales.
Journal d'Agriculture Tropicale.
Bulletins, Bureau of Plant Industry,
United States Department of Agriculture.
El Comercio (New York).
Journal d'Agriculture Pratique.
Revue Horticole.
The Pacific Rural Press.
De Indische Mercur.
L'Agriculture Pratique des Pays Chauds.

The Agricultural Ledger.
Der Tropenpflanzer Zeitschrift.
Journal of the Linnean Society, Botany.
Botanische Jahrbücher für Systematik
Pflanzengeschichte und Pflanzengeo-
graphie von A. Engler.
Annales des Sciences Naturelles, Botan-
ique.
Teysmannia.
Bulletin of the Botanical Department,
Jamaica (exchange).
Botanical Gazette.
Bulletin of the Torrey Botanical Club.
Agricultural Bulletin of the Straits and
Federated Malay States (exchange).
Curtiss Botanical Magazine.
The Journal of Botany.
The Experiment Station Record (ex-
change).
The American Naturalist.
Notizblatt des Königl. Botanischen Gar-
tens und Museums zu Berlin.
Botanische Zeitung.
Annales de Botanique.
Hooker's Icones Plantarum.
Official Gazette.

EXHIBIT A.

PHILIPPINE AGRICULTURAL PRODUCTS, WITH BRIEF DESCRIPTIONS OF THE PLANTS, THEIR DISTRIBUTION AND USES, COMPILED FROM THE REPORTS OF CORRESPONDENTS OF THE BUREAU, BY F. LAMSON-SCRIBNER.

MANILA, September 2, 1903.

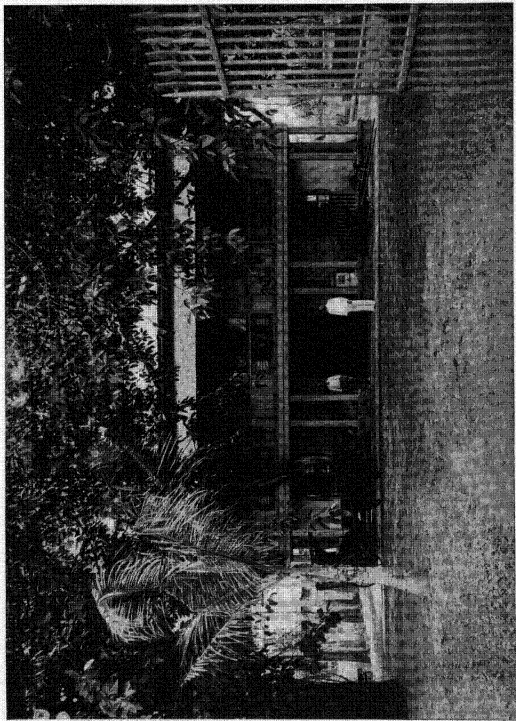
- Achras sapota*, Linn.—Chico (Sp. T.); Chicle (Eng.). A tree, 15 to 20 feet high, introduced from America, and cultivated in gardens throughout the archipelago. The fruit is edible and the sap yields valuable gum. It is highly appreciated.
- Agaricus* sp.—Payong ahas (T.); Agarico (Sp.); Agaric or Mushroom (Eng.). An umbrella-shaped cryptogamous plant, found in Luzon and the Visayan and Mindanao islands. The entire plant is edible. Many species of *Agaricus* and genera related to them grow spontaneously throughout the archipelago.
- Agathis loranthifolia*, Salisb.—A lofty tree, from which the valuable resin called “Almaciga,” dammar of commerce, is extracted. It is found on the mountains of southern Luzon and Panay Islands at elevations of from 500 to 1,000 meters. The resin is sold in Manila at \$7 to \$8 Mexican per picul.
- Albizzia procera*, Benth.—Adyangao. A tree furnishing a resin used as incense.
- Albizzia saponaria*, Blume.—Cogontoco. Yields resin for lighting purposes.
- Aleurites saponaria*, Blanco.—Baguilmuban (T.); Balocanad (V.); Balucanang (Il.); Calumban. A native tree of Luzon and the Visayan Islands. The fruit is used in the manufacture of an ordinary kind of soap sold in Manila.
- Aleurites triloba*, Forst.—Capili, Lumbang (T.). A tree growing in Luzon and the southern islands. The fruit is used for making oil for illuminating purposes and a fertilizer, both of which are largely sold in Manila.
- Allium cepa*, Linn.—Lasona; Sibuyas (T.); Cebolla (Sp.); Onion (Eng.). A vegetable grown throughout Luzon and the Visayan Islands. The bulb and leaves are used in cookery.
- Allium sativum*, Linn.—Bawang (T.); Ajo (Sp.); Garlic (Eng.). An herb raised in small quantity throughout the archipelago. The leaves and bulb are used as a condiment.
- Allium tricocum*, Ait.—Cuchay, Cutsay (T.); Ganda (V.); Wild Leek (Eng.). A bulbous plant grown in the gardens of Luzon and other islands occasionally; spontaneously in Leyte. The leaves are used for condiment.
- Amaranthus spinosus*, Linn.—Bayang-bayang (Il.); Calites (V.); Coletes (T.); Colitis (T.); Cuanton, Harum (V.); Orayi. A native herb, 2 to 3 feet high, found on Luzon, the Visayan Islands, etc. The ash made from the plant is used for dyeing.
- Anacardium occidentale*, Linn.—Balubad (T.); Balubat (Pn.); Balurad (T.); Bologo (Il.); Casoy (T.); Cashew (Eng.). A small tree or tall shrub, raised in small quantities upon Luzon and other islands, having been introduced from tropical America. Fruit and seeds are edible; the former for dessert, and the latter to mix with chocolate after being roasted. Oil is obtained from the seeds.
- Ananas sativus*, Schult.—Piña (T. Sp.); Pineapple (Eng.). An herb raised throughout the archipelago for the flavor of its fruit, for local consumption.
- Anisoptera thurifera*, Blanco.—Lauan. A large tree that yields transparent, hard, and odorous resin of white-yellowish color, esteemed in commerce and used as incense, for the manufacture of varnishes, and for calking boats. Found throughout the archipelago.
- Anisoptera oblonga*, Dyer.—Sandana. A tree like Lauan, and grows in the southern part of Luzon, and the islands of Leyte and Mindanao. It yields a resin which is aromatic.
- Anona muricata*, Linn.—Gayubano (Il.); Guanabano (P. Il.); Guayabano (T.); Guyabano (T. V.); Guanabena, Suisaak, Susakka, Soursop (Eng.). A tree, 20 feet or more in height, found in Luzon and the Visayan Islands, introduced from America. The fruit is edible and good for preserves.
- Anona reticulata*, Linn.—Anonas (Sp. T.); Custard Apple (Eng.). An exotic tree from Mexico, 10 to 20 feet high, grown for local consumption on Luzon Island. The fruit is edible.
- Anona squamosa*, Linn.—Ates (T. Sp.); Atis (V.); Natis (P.); Sugar Apple, Sweet-sop (Eng.). A small tree or shrub whose fruit is edible. It is highly prized and is found on Luzon and other islands, and used for local consumption.
- Antidesma bunius*, Spreng.—Bignay (P.); Bugnay (T.). A tree growing wild in Pampanga, Rizal, and other provinces. The fruit is edible, and is good for preserves.

- Apium graveolens*, Linn.—Quinchay, Quinsay (T.); Apio (Sp.); Celery (Eng.). A garden vegetable, growing throughout the archipelago, used locally. The leaf-stalk is used for dressing.
- Apium petroselinum*, Linn.—Perejil (Sp.); Parsley (Eng.). A garden vegetable cultivated for local consumption.
- Arachis hypogæa*, Linn.—Mani (T.); Cacahuete (Sp.); Ground Nut, Peanut (Eng.). An herb, cultivated in Luzon and other islands for forage. The seed is edible and is used for making oil, etc.
- Areca catechu*, Linn.—Bonga, Bunga (T); Bonga (Sp.); Betel Nut (Eng.). A palm raised in all gardens throughout the archipelago. It grows to a height of about 30 feet. The nut is chewed by the natives. The leaves, stalks, and seeds are also utilized.
- Artocarpus camansi*, Blanco.—Camance, Camansi (V.); Camongsi, Dalangian, Dolongian; Pacac (Il.); Breadfruit (Eng.). A tree, 60 feet or more in height, growing in Luzon, Antique, Iloilo, and other islands, though rarely cultivated. The seed may be eaten raw or cooked. The flowers are good for sweetmeats.
- Artocarpus incisa*, Linn. f.—Antipolo, Rima (T.); Tipolo (P.); Breadfruit (Eng.). A tree growing to a height of about 60 feet, found throughout the archipelago. It is sometimes planted. The sap, bark, and fruit are utilized. The fruit is valued for preserves.
- Artocarpus integrifolia*, Linn. f.—Anangca (Il.); Langka, Nangka (T.); Jak Fruit (Eng.). A tree, 20 to 30 feet high, raised in gardens throughout the archipelago for local consumption. The fruit is eaten raw or cooked, and is good for preserves. The seeds when boiled or baked somewhat resemble chestnuts.
- Artocarpus rima*, Blanco.—Colo (V.); Ogob (B.); Rima (T.); Breadfruit (Eng.) A tree planted in the gardens of Luzon and other islands. When cooked the fruit is eaten, and is valued for making sweetmeats.
- Asparagus officinalis*, Linn.—Espárrago (Sp.); Asparagus (Eng.). An introduced garden vegetable raised in very small quantities in Cebú, Ilocos, and Manila. The young stalks are eaten when cooked.
- Asplenium esculentum*, Presl.—Pacó (T.) A common fern growing spontaneously in Luzon and other islands. The young leaves are used as a vegetable.
- Averrhoa bilimbi*, Linn.—Camias (T.); Kamias (B. T.). A small tree raised in gardens on the island of Luzon. The fruit is used for dressing, sweetmeats, etc.
- Averrhoa carambola*, Linn.—Balimbing, Balinbin, Bilimbin (T.); Carambola, Coromandel Gooseberry (Eng.). A tree, about 25 feet high, cultivated in gardens of Luzon and other islands. The fruit is eaten raw and used for desserts, etc.
- Bauhinia tomentosa*, Linn.—Alibanban (T.). A small tree, 20 feet high, growing wild in Rizal, etc. The leaves yield an acid used as a substitute for vinegar.
- Beta vulgaris*, Linn.—Acelga (Sp.); Beet (Eng.). A vegetable found nearly throughout the archipelago, especially in Benguet; produced for local consumption. The leaves are used as a condiment, etc., and the fleshy roots are edible when cooked.
- Bica orellana*, Linn.—Achiote (T.); Achote, Achuete (Sp.); Anatto, Annotta, Arnotto (Eng.). A small tree or shrub, about 10 feet in height, found throughout the archipelago, although not largely grown; introduced from tropical America. The fruit yields a coloring matter and is used in cookery, to color butter, etc.
- Brassica oleracea*, Linn. var.—Repollo (Sp. T.); Cabbage (Eng.). A vegetable, raised to a large extent in Luzon Island, etc., for local use. The leaves are edible.
- Brassica oleracea*, Linn. var.—Coliflor (Sp.); Cauliflower (Eng.). A vegetable found in Pampanga and other provinces, but rarely raised. The bud is used for pickling.
- Cassalpinia sappan*, Linn.—Sapang, Sibucan (T.); Palo-Brasil (Sp.). A tree, 14 feet or more high, growing in Luzon and Panay islands, which yields a red coloring material, sold largely in Manila markets, and exported to China and England.
- Cajanus indicus*, Spreng.—Cadios, Cadiws (V.); Caguios (T.). A vegetable found in Occidental Negros, Romblon, Antique, etc., though rarely planted.
- Calophyllum inophyllum*, D. C.—Bitanhol, Bitao (T.); Dancalan, Dincalin, Tamaui-an; Palo Maria (Sp.). A tree, growing wild upon the seashores throughout the archipelago. The seeds are used in making oil, and the bark yields a resin, both highly appreciated by the natives.
- Cananda odorata*, H. F. et T.—Alangilang (T.); Angilang (V.); Ilang-ilang (T. Sp.). A tree, 25 to 40 feet high, found throughout the archipelago. It is highly prized and grown for commerce, especially around Manila, Mindoro Island, etc., being valued for its flowers, which yield a fine perfume. The essence, called "Ilang-ilang," is exported to France, England, China, and Singapore.

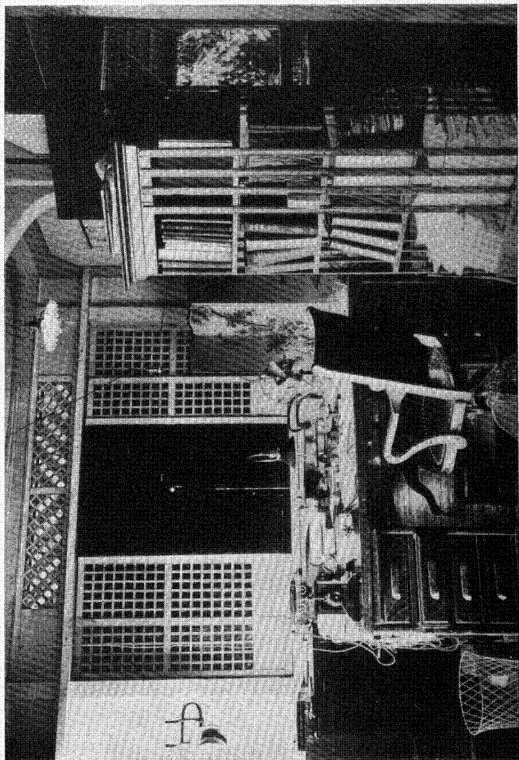
- Canarium album*, Blanco.—Pilani (T.); Pili (V.). A tree found in southern Luzon, and sometimes planted. The nut and sap are utilized, the latter being produced on a commercial scale.
- Capparis mariana*, D. C.—Alcaparras (Sp.); Capers (Eng.). A shrub, 7 feet high, whose buds and fruits are used as condiments. It is found in Rizal Province, and is very scarce.
- Capsicum* sp.—Chile, Sile (T.); Pimiento (Sp.); Red Pepper (Eng.). An herb or shrub, many varieties of which are cultivated as garden vegetables throughout the archipelago. The leaves and fruit are used in cookery.
- Capsicum minimum*, Roxb.—Chileng Bundoc (T.); Pasitis; Guindilla (Sp.); Red Pepper (Eng.). A shrub found upon Luzon Island. It is sometimes planted, and the fruit is used in cookery, etc.
- Carica papaya*, Linn.—Capayas (V.); Papaya (T. Sp.); Pawpaw. A small tree, 20 feet high, of American origin, a garden product throughout the archipelago. The fruit is sweet and pleasant to the taste, and is used in making sauces, preserves, pickles, and desserts. There are two sexes, the flowers being dioecious.
- Caryota onusta*, Blanco.—Caong, Cauong, Iroc (T.). A sort of sago is extracted from the fibrous stalk of this palm; and also tuba from an incision in the fruit.
- Caryota urens*, Linn.—Banga or Pugahan (T.). A palm producing a starch or a species of sago of good quality.
- Castanopsis philippinensis*, Vidal.—Talacatac; Wild Chestnut (Eng.). A tall tree found on Luzon and other islands, though not cultivated. The fruit is utilized.
- Chenopodium ambrosioides*, Linn.—Alpasotes, Apasotis (T.). A native herb found wild throughout the archipelago. The leaves are used for seasoning food.
- Cichorium endivia*, Linn.—Escarola (T. Sp.); Endibia (Sp.); Endive (Eng.). A garden vegetable raised for local consumption on Luzon, etc. The leaves are used for salad.
- Cinnamomum burmanni*, Blume.—Canela (T. Sp.); Cinnamon (Eng.). A small tree or shrub whose bark is used as a spice. It is found in the Philippines, especially in Mindanao, and formerly was cultivated.
- Cissus acida*, Linn.—Caguindi (V.); Calit-calit, Cavilan (T.); Culutpamu (P.); Langingi, Lopo, Lopo-lopo, Lupo, Pacopol (V.) A native climbing herb, growing spontaneously on Visayan and Luzon islands. The young stems and leaves are edible and used as a substitute for vinegar.
- Citrullus vulgaris*, Schrad.—Pakwan (T.); Sandia (Sp.); Watermelon (Eng.). An herbaceous vine, grown in small quantities throughout the entire archipelago. The fruit is used for dessert, the best being raised in Bulacan.
- Citrus aurantium*, D. C.—Cagel, Cahil (T.); Large Lemon (Eng.). A fruit tree, growing on Luzon and other islands, whose fruit is highly esteemed. This tree furnishes a resin used for illuminating purposes.
- Citrus decumana*, Linn.—Lucban, Suha (T.); Naranja (Sp.); Orange (Eng.). A tree, 20 to 25 feet high, several varieties of which are planted in gardens throughout the islands of Luzon, Visayas, and Mindanao. The fruit is edible.
- Citrus medica*, Linn.—Limon real (Sp.); Lemon (Eng.). A small tree, a garden product of Luzon and Panay, valued for its fruit.
- Citrus medica*, Linn. var. *acida*.—Dalayap (T.); Limon (Sp.); Lemon (Eng.). A shrub grown in the gardens of Luzon Island, etc. The fruit is used for seasoning.
- Citrus mitis*, Blanco.—Calamansi, Calamunding (T.); Limoncito (Sp.); Small Lemon (Eng.). A small tree, 10 to 15 feet high, found in nearly all gardens. The fruit and leaves are utilized for condiment and also in bathing as a perfume.
- Citrus notissima*, Blanco.—Dayap (T.); Limon (Sp.); Lemon (Eng.). A shrub or very small tree, cultivated in the gardens of Luzon and other islands, and highly prized. The fruit is used in cookery, etc.
- Citrus reticulata*, Blanco.—Naranjitas, Sintones (T. Sp.); Small Oranges (Eng.). A tree, growing upon Luzon and other islands. The fruit is highly prized, especially that from Laguna. It is grown commercially.
- Citrus torosa*, Blanco.—Cabuyao (T. P.); Colobot (T.). Lemon tree, grown rarely in the island of Luzon for local use. The fruit is utilized in bathing and bleaching, and is edible, though not ordinarily used as an article of food.
- Cocos nucifera*, Linn.—Niog (T.); Coco (Sp.); Coconut (Eng.). A palm, widely cultivated throughout the archipelago. Wine, vinegar, and many other products are manufactured from the sap, fruit, nut, leaves, veins, etc. Copra, the principal product, is largely exported.
- Coffea arabica*, Linn.—Cafe (T. Sp.); Cahaua (M.); Coffee (Eng.) A bush, 8 feet high, more or less, found throughout the Philippine Islands. It is valued for the seed (berry), which is a staple product, the best quality being grown in Batangas.

- Colocasía antiquorum*, Schott. var.—Dagmay (V.); Gabe, Gaby (T.); Gallang (B.); Gave (Il. Z.). A perennial herb, cultivated throughout the archipelago. The fleshy roots, leaves, and young shoots are used for food.
- Colocasía esculenta*, Schott.—Caladi (V.). A perennial herb, raised in small quantities on Panay Island. The leaves, young shoots, and starchy roots are edible.
- Convolvulus repens*, Willd.—Cancong (T.); Tancong, Tangcong (V.). An aquatic vine, growing wild throughout the archipelago. The stem is used in making salad, etc.
- Corchorus obtortus*, Linn.—Saluyot (Il.). A shrub, found in Ilocos Norte; sometimes planted. The leaves are eaten when cooked.
- Coriandrum sativum*, Linn.—Cilantro, Comino (Sp.); Culantro, Ongsoy (T.). An herb, raised in small quantities as a garden vegetable on Luzon and other islands, whose leaves, stem, and seed are used for dressing.
- Corypha umbraculifera*, Linn.—Buri (T.). A lofty and beautiful palm, very well known in the Philippines for its usefulness, giving name to the island of Burias, where it is found abundantly. Sago of commerce is obtained from the soft interior part of the trunk. The fruit is edible, and tuba is obtained from an incision in the same. The tuba is made into wine and also a sort of sugar called pacasas, resembling maple sugar.
- Crocus sativus*, Linn.—Dilao (T.); Azafran (Sp.); Saffron Crocus (Eng.). A perennial herb sparingly grown in Luzon and other islands. The root is used for seasoning.
- Cucumis melo*, Linn. var.—Atimon, Catimon (V.); Melon (Sp.); Milon (T.); Melon (Eng.). An herbaceous vine raised for local consumption in Panay, Luzon, etc. The fruit is valued for dessert.
- Cucumis sativus*, Linn.—Calavaga (V.); Pepino (T. Sp.); Cucumber (Eng.). An herbaceous vine raised in small quantities throughout the Philippines. The fruit is used for making salad, etc.
- Cucurbita lagenaria villosa*, Linn.—Calabasang puti, Opo, Upo (T.); White Squash (Eng.). A tendril climbing plant, raised as a garden vegetable for local consumption throughout the archipelago. The fruit is eaten when cooked.
- Cucurbita maxima*, Duchesne.—Calabasang pula, Calabasang Bilog ((T.); Red squash (Eng.). A vinelike herb found throughout the archipelago, several varieties of which are grown for local use. The flowers and fruit are used for condiment, sweetmeat, etc.
- Cucurbita pepo*, Linn. var. *Aspera*.—Condol (T. Sp.) An herbaceous vine, grown for local use in Luzon and other islands. The fruit is used for making sweet meats, etc.
- Daucus carota*, Linn.—Carrot (Eng.); Zanahoria (Sp.). An herb cultivated for local use in Camarines, Cavite, Cagayan, etc. The root is edible.
- Dillenia philippinensis*, Rolf.—Catmon (T.). A tree the acid fruit of which is used by the natives as a substitute for vinegar.
- Dioscorea alata*, Linn.—Ube (T.); Yam (Eng.). A climbing herb growing on Luzon and other islands, sometimes raised to a large extent. The tuber is used as an article of food.
- Dioscorea divaricata*, Blanco.—Baliacag (V.); Cobag; Dulian (Il.); Obat; Paquit; Chinese Potato, Yam, Cinnamon Vine (Eng.). A tall climbing plant with edible tubers. Found in northern Luzon and the Visayan Islands, and is sometimes cultivated.
- Dioscorea papillaris*, Linn.—Tongo, Tungo (T.). A vine found wild, but sometimes planted for its edible root or tuber.
- Dioscorea pentaphylla*, Linn.—Lima, Lima-lima, Nami-conot, Sap-ang. A vegetable growing in Luzon, Panay, Negros, Cebu, etc., though rarely cultivated. The tuberous root is edible.
- Dioscorea sativa*, Linn. var.—Togui, Tugue, Tugueng pulo (T.). A vine grown as a garden vegetable in Luzon and other islands. The tuberous root is edible.
- Dioscorea triphylla*, Pers.—Calut (P.); Carot (Il. V.); Corot (V.); Gayos (V.); Karot (Il.); Nami (T.). A vegetable found in Luzon and the Visayan Islands. The root is eaten when cooked. In times of scarcity it becomes a staple article of food among the mountaineers. The juice is also used.
- Diospyros cunalon*, D. C.—Cunalon. A tree the bark of which when dried and reduced to a powder produces a black coloring matter used by the natives for dyeing purposes.
- Diospyros discolor*, Willd.—Mabolo (T.); Talang (P.); Persimmon (Eng.). A native tree growing wild and also planted in gardens in Luzon and other islands. The fruit is edible.

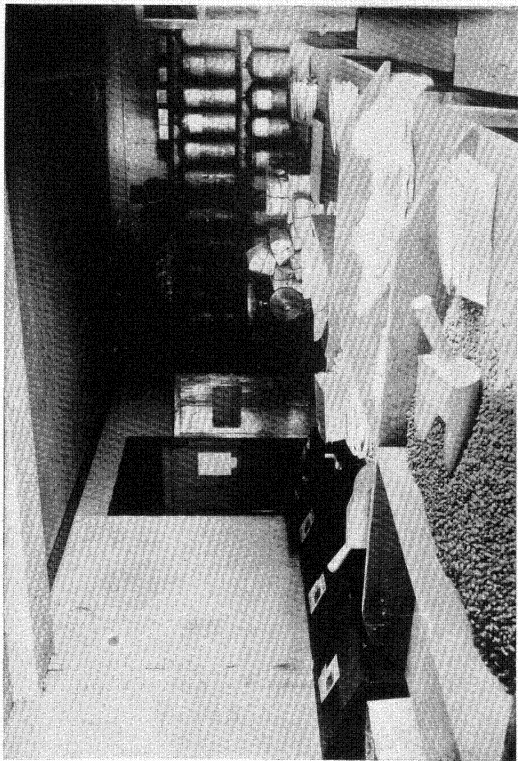
- Diospyros ebenaster*, Retz.—Sapote, Zapote (T.); Persimmon (Eng.). A tree found in Cebu, Luzon, Mindanao, and Panay islands, though rarely planted. The fruit is edible.
- Diospyros pilosanthera*, Blanco.—Amaga (V.); Bolongaeta (T.); Dalongdong (V.); Persimmon (Eng.). A native tree whose fruit is edible, found in the Visayan Islands and Luzon.
- Dipterocarpus grandiflorus*, Blanco.—Apitong, Hapitong. A tall tree which yields excellent resin; sold in Manila market and exported; used for varnishing. Found in Luzon, Visayan, and Mindanao islands.
- Dipterocarpus malaanonan*, Blanco.—Malaanonang. A large tree producing an aromatic resin used for calking.
- Dipterocarpus pilosus*, Roxb.—Hagachac. A resinous big tree found in Mindanao, Visayan, and Luzon islands.
- Dipterocarpus turbinatus*, Gaertn.—Mayapis. A tall resin-yielding tree, found throughout the archipelago.
- Dipterocarpus vernicifluus*, Blanco.—Balao (T.); Malapaho (T. V.). A tree growing wild in parts of Luzon, Mindanao, and the Visayan Islands, yielding a resin used for varnishing, calking ships, and illuminating.
- Dolichos echinulatus*, Blanco.—Quibal. An herbaceous vine produced in Batangas as a garden vegetable. The fruit is edible.
- Dolichos sesquipedalis*, Linn.—Camangeg (Il.); Camangian (P.); Otong; Sitao (T.); Long Yard Bean (Eng.). A twining plant, found throughout the archipelago and cultivated as a garden esculent. The green pods and dry beans are edible.
- Dracontomelum* Sp.—Alanihao (V.). A native tree, 90 feet or more in height, found in Romblon. The fruit is edible.
- Eugenia jambolana*, Lam.—Dujat (T.); Lombuy (V.); Lomboy (Sp.); Lumboy (T.); Jambolan or Jambolan Plum (Eng.). A tree found in both a wild and a cultivated state on Luzon and other islands. The fruit is used for dessert.
- Eugenia jambos*, Linn.—Tampoy (T.); Rose Apple, Jamrosade (Eng.). A tree raised as a garden product in Cebu, Luzon, and Panay. The fruit is edible, and is used for making jelly.
- Eugenia malaccensis*, Linn.—Macopa, Macupa (T.); Yambo (P.); Poma-rosa (Cuba); Otaheite Apple (Eng.). A tree about 30 feet high, a garden product of Luzon and other islands. The fruit is edible.
- Euphoria litchi*, D. C.—Alipai (T.); Alopay, Alpay, Alupay, Alupe; Lechia (Sp.). A native tree of Luzon and other islands, yielding an edible fruit.
- Ficus glomerata*, Roxb.—Tibig na lalaqui; Cluster Fig. A shade tree growing by the streams of Luzon. The fruit is small and is much relished by children, and also by cattle. The tree is highly valued by the natives, for the reason that the roots yield drinking water.
- Feniculum vulgare*, Gaertn.—Anis Estrellado (Sp.); Fennel (Eng.). A perennial plant, raised in very small quantities, but found throughout the archipelago. The seeds are used for dressing, sweetmeats, etc.
- Garcinia mangostana*, Linn.—Mangostan (T. Sp.); Mangosteen (Eng.). A tree growing on Jolo and Mindanao Islands, and known by the name of "King's Fruit." The fruit is sweet, and has a very delicate flavor. It is much prized.
- Hernandia peltata*, Meisen.—Colong colong (T.). A native tree found in Luzon. Oil is made from the nut.
- Heptapleurum caudatum*, vid.—Limolimo. Yields a resin used for making varnish.
- Homalanthus populifolius*, R. Grah.—Balante. A tree whose bark when dried and reduced to a powder yields black coloring matter used by the natives.
- Hopea plagata*, vid.—Yacal. A lofty tree yielding transparent resin.
- Indigofera tinctoria*, Linn.—Ameri (B. C.); Mariana, Tagom, Tagum (V.); Tayom (T.); Tayung (P.); Añil (Sp.); Indigo (Sp. Eng.). A small leguminous shrub about 5 feet in height, grown in Luzon and other islands. The entire plant, with the exception of the roots, furnishes a blue dyestuff known as indigo, which is much used in the industries. It is also raised to a considerable extent in Ilocos and Pangasinan, where the plant is known by the name of Indigo.
- Ipomea batatas*, Poir.—Camote, Camoti (T.); Sweet Potato (Eng.). A trailing vine, many varieties of which are largely cultivated throughout the archipelago, and constitutes a staple product. The tuberous root and the leaves and shoots are the parts used.
- Jasminum sambac*, Linn.—Sampaguita. A plant with white, fragrant flowers, from which a highly prized essence is produced.
- Jatropha curcas*, Linn.—Casla (V.); Tava-tava, Tawatawa (Il.); Tuba (T.); Physic Nut or French Physic Nut (Eng.). A native shrub, about 8 feet high, found wild and planted for fences throughout Luzon and other islands. The fruit is used for making oil and is purgative.



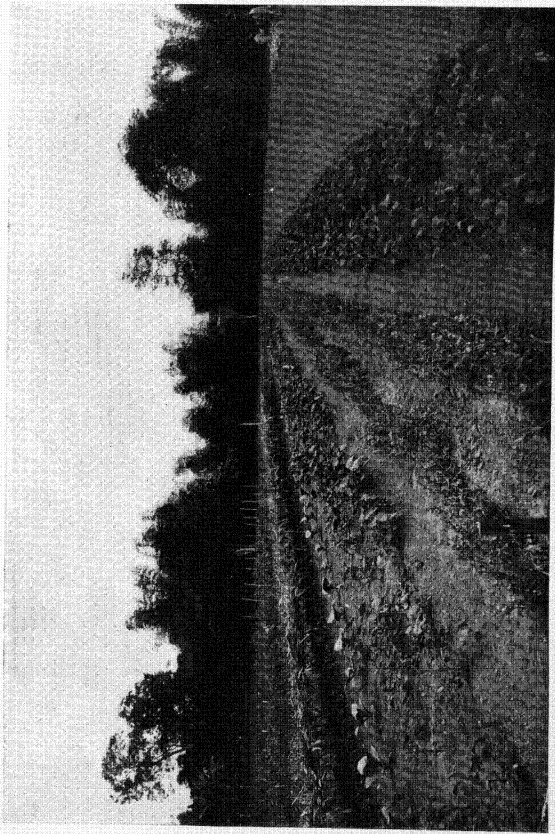
BUREAU OF AGRICULTURE, MANILA, P. I.



OFFICE OF CHIEF OF BUREAU OF AGRICULTURE.



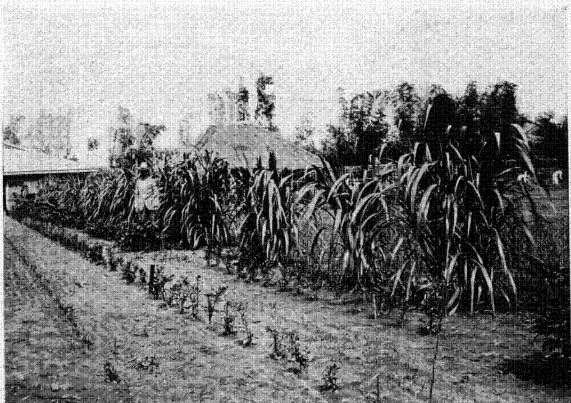
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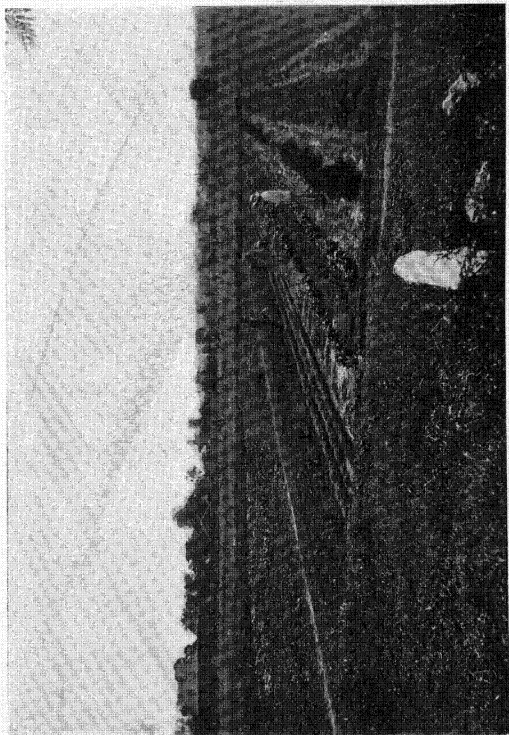
MALATE EXPERIMENT STATION.



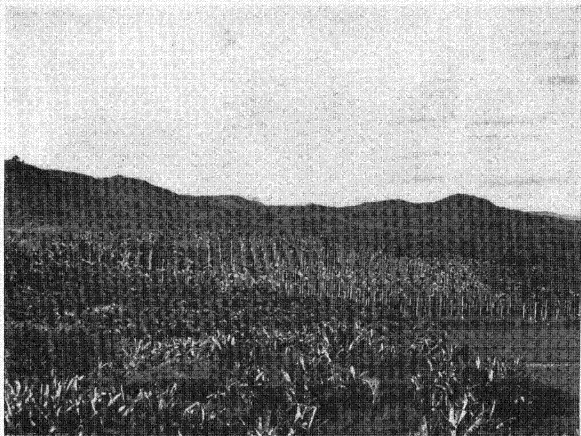
WATER-TOWER EXPERIMENT STATION, MALATE.



YOUNG SUGAR CANE FROM HAWAII GROWING AT EXPERIMENT STATION, MALATE.



EXPERIMENT STATION AT BATANGAS.



VIEW ON COLLEGE FARM, NEGROS OCCIDENTAL.



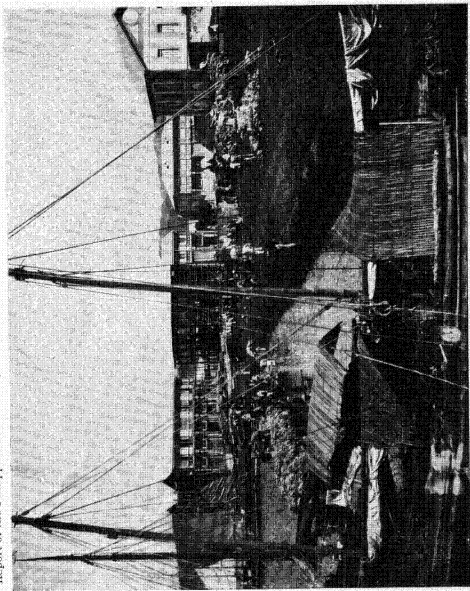
VIEW ON OUR COLLEGE FARM NEAR CARLOTA, NEGROS OCCIDENTAL.



TYPES OF LABORERS ON SAN RAMON FARM.



ABACÁ IN FRUIT, SAN RAMON FARM.



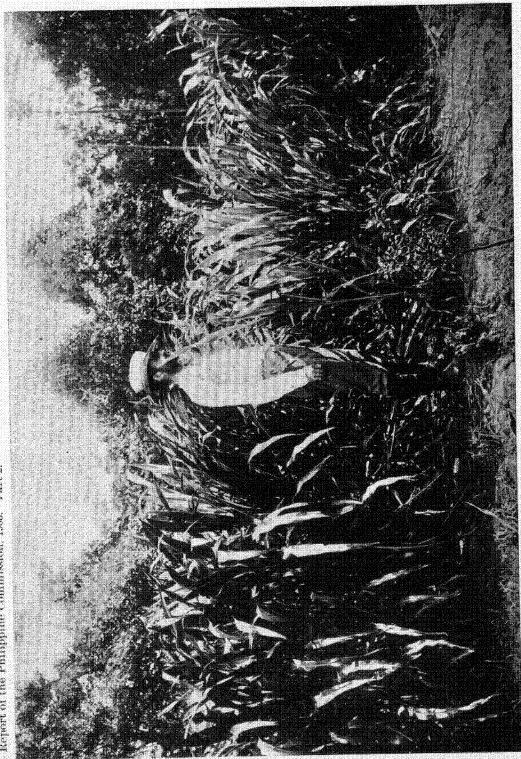
LANDING ABACÁ AT CEBU.



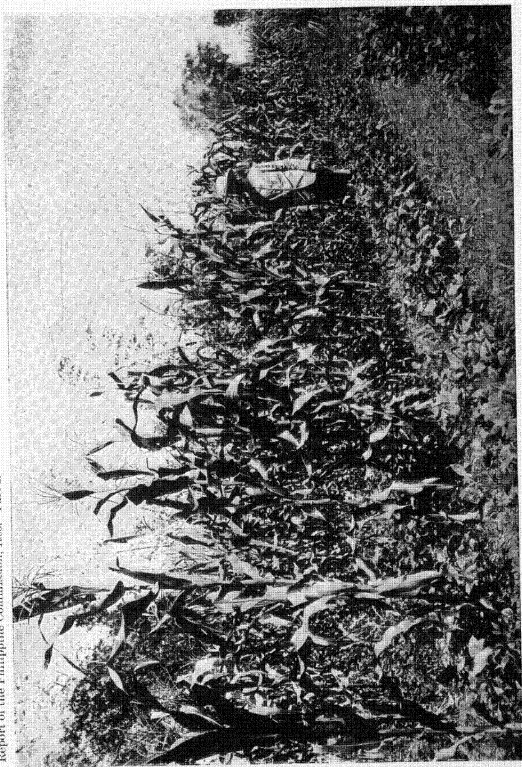
AN AVENUE OF COCOANUT TREES, SAN RAMON FARM.



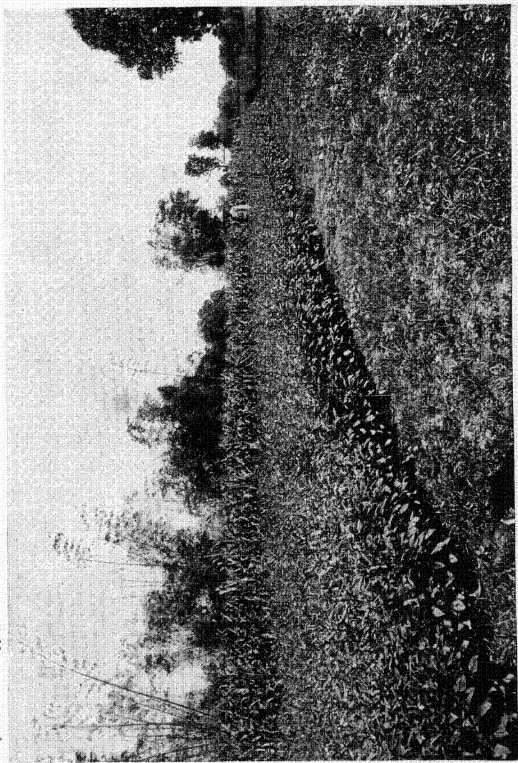
ABACÁ PLANTATION AT SAN RAMON, MINDANAO.



TEOSINTE READY FOR FIFTH CUTTING.

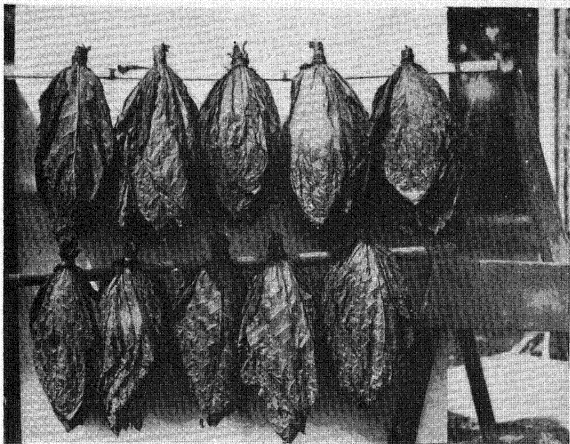


MAIZE OR INDIAN CORN FROM NATIVE SEED, TRIAL GROUNDS OF BUREAU OF AGRICULTURE.

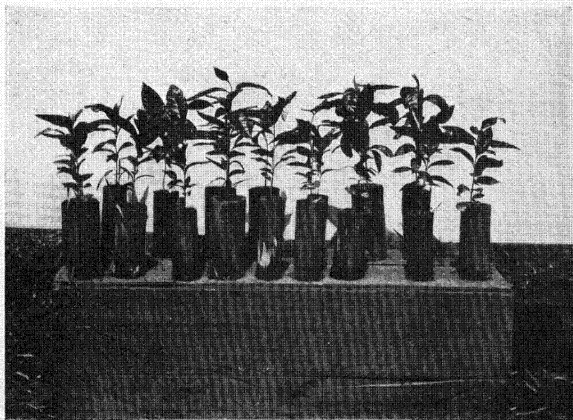


PLAT OF SESAMUM ON TRIAL GROUNDS OF BUREAU OF AGRICULTURE.





SUMATRA TOBACCO, GROWN ON EXPERIMENT STATION, MALATE.



YOUNG COFFEE PLANTS, GROWING IN BAMBOO POTS.



- Jatropha multifida*, Linn.—Mana (T. Sp.). A shrub growing wild in Bulacan and Rizal, though sometimes planted. The fruit is used and is a purgative.
- Justicia corrosiva*, Linn.—Atay-atay (V.). A shrub planted in gardens for ornament; the leaves are used medicinally. It is found in the Visayan Islands.
- Lablab cultratus*, D. C.—Batao (T.); Bulay (P.). A vine raised in small quantities in Albay, Bulacan, Occidental Negros, Nueva Ecija, Rizal, Tarlac, and Zambales. The fruit is used as a vegetable.
- Lactuca sativa*, Linn.—Lechuga (Sp.); Lettuce (Eng.). A garden vegetable locally raised throughout the archipelago. The leaves are used for making salad.
- Lansium domesticum*, Linn.—Boboa (T.); Boocan; Bulahan (T.); Lanson (V.); Lanzones (Sp. T.). A small tree of beautiful appearance, 15 feet or more in height, found in Luzon and other islands. Cultivated to a large extent in Laguna Province, and is very highly esteemed. The fruit is eaten raw and prized as a dessert.
- Leersia hexandra*, Swartz.—Barit (T.); Zacate (Sp.). A grass which is cut by hand and sold green for feed for horses. An important industry in Manila.
- Limonia trifoliata*, Linn.—Limoncitos. A shrub, about 8 feet in height, growing spontaneously in Luzon and other islands. The fruit is esteemed for seasoning sweetmeats. Same as *Triphasia trifoliata*, D. C.
- Lucuma mamosa*, Gaertn.—Mamey (T.); Chico Mamey (Sp.); Marmalade Plum (Eng.). A tall shrub, growing in gardens, in Laguna, valued for its fruit.
- Luffa acutangulus*, Roxb.—Patola (T.); Sponge Cucumber (Eng.). Cultivated as the following variety, for local consumption. The matted fibers of the fruit of this variety or the following one are being exported from Japan for lining hats and slippers.
- Luffa aegyptiaca*, Mill.—Patola (T.); Sponge Cucumber (Eng.). An annual tendrill-climbing plant, raised as a garden vegetable throughout the archipelago. The green fruit is edible, and is cooked like squash, or served in soups and stews.
- Lycopersicum esculentum*, Mill.—Camatis (T.); Tomato (Sp.); Tomato (Eng.). An herb of American origin, of which several varieties are raised throughout the archipelago. The fruit is utilized for dressing, sweetmeats, etc., and is eaten raw or cooked.
- Mangifera altissima*, Blanco.—Paho, Pajo (T.); Pao. A tree grown to a small extent in Luzon and other islands. The fruit is highly prized, and is utilized for pickling, etc.
- Mangifera indica*, Linn.—Mampalam (J. M.); Manga (T.); Manga (Sp.); Mango (Eng.). A tree 30 to 50 feet in height, grown to a large extent throughout the entire archipelago. The fruit is harvested during spring and summer, and is highly esteemed for dessert, jelly making, etc.
- Manihot utilissima*, Pohl.—Camoteng cahoy (T.); Adam's Needle, Casave or Yucca (Eng.). A shrub, about 10 feet high, of American origin. The well-known tapioca is extracted from the starchy fecula of its roots. It is found both wild and cultivated in some provinces. The natives make a good sweetmeat of the roots, which finds a ready sale among them.
- Maranta arundinacea*, Linn.—Ararao (T.); Araro (V. P.); Bermuda Arrowroot (Eng.). An herb sometimes grown for local use in Luzon and other islands. The starchy roots are used for making arrowroot and sago.
- Melastoma polyanthum*, Blume.—Aguisip. A tree, from the bark of which a bright red coloring matter is extracted. It is used to dye hemp clothes.
- Memecylon tinctorium*, Pers.—Candong (Il.); Colis (T.); Saguinsin (V.). A tree growing spontaneously in Luzon and Visayan islands. The leaves are used for dyeing purposes.
- Metroxylon rumphii*, Mart.—Bagsang. A very common palm in the Visayan Islands; grows spontaneously in moist regions. The heart of the tree is reduced to a sort of flour, which is made into cakes or fritters and eaten with cocoanut milk; a wholesome and nutritious food.
- Metroxylon silvestre*, Mart.—Lumbia or Lumbay. A palm from which a sort of flour is obtained, which serves as food to the poorer classes in times of scarcity.
- Mezoneurum glabrum*, Desf.—Cabitcabag, Sagnit, Sapnit; Togabang (V.); Tugabang; Ugabang (V.). A woody vine found on Luzon and the Visayan Islands, though not cultivated. The tender stems are cooked and used for making salad; the leaves are used medicinally.
- Michelia champaca*, Linn.—Champaca. A tree, 15 feet high, cultivated in gardens. A fine essence is extracted from its flowers.
- Mimusops elengi*, Linn.—Cabiqui (T.). A native tree, about 40 feet high, found on Luzon and other islands, whose fruit is edible and the flowers of which are very fragrant. It is sometimes planted in gardens.

- Momordica balsamina*, Linn.—Ampalaya, Ampalea (T.); Apale Apalia (V.); Palaya (B.); Palla, Paria; Amargoso, Balsamina (Sp.); Balsam Apple (Eng.). An annual climbing herb, raised for local consumption in Luzon and other islands. The fruit and leaves are used as condiment for salad, etc.
- Morinda tinctoria*, Roxb.—Bancuro. A tree whose root produces a red coloring material, used for dyeing purposes.
- Morinda umbellata*, Linn.—Salicsican. A tree from the roots of which the natives extract a red dyestuff.
- Moringa oleifera*, Lam.—Arongay (Il.); Arungay (P.); Balongay, Balungay (V.); Camalongay, Camalugay; Malungay (T.); Marungay (Il. V.); Horse-radish tree (Eng.). A native tree, about 15 to 25 feet high, found wild throughout almost the entire archipelago; sometimes planted for its fruit, leaves, shoots, and roots, which are used for various purposes.
- Muntingia calabura*, Linn.—Datiles, Ratiles (T.). A small tree, about 15 feet high, of American origin, growing spontaneously in Luzon Island. The fruit is edible, though seldom used.
- Musa paradisiaca*, Linn. var.—Saguing (T.); Platano (Sp.); Banana (Eng.). The native name for all kinds of bananas is "Saguing."
- Musa paradisiaca compresca*, Blanco.—Bisco; Saba (T.); Saba Iloco; Platano (Sp.); Banana (Eng.). A variety of banana raised on a commercial scale throughout the archipelago.
- M. paradisiaca lacatan*, Blanco.—Lacatan (T.); Platano (Sp.); Banana (Eng.). A variety of banana grown in Luzon and other islands for its fruit, which is highly prized. It is claimed to be one of the best varieties on account of its superior flavor.
- M. paradisiaca magna*, Blanco.—Tondoc (T. V.); Tunducque (T.); Platano (Sp.); Banana (Eng.). A variety of banana tree grown on a small scale in Luzon and other islands as a garden product. The large fruit is edible.
- M. paradisiaca maxima*, Blanco.—Batavia (T.); Matavia (V.); Platano (Sp.); Banana (Eng.). Banana tree, found in Luzon and other islands and valued for its fruit.
- M. paradisiaca suaveolens*, Blanco.—Bungulan (T.); Platano (Sp.); Banana (Eng.). A variety of banana widely grown for its fruit.
- M. paradisiaca ternatensis*, Blanco.—Gloria (T.); Taranate (P.); Ternate (T.); Platano (Sp.); Banana (Eng.). A high tree-like herb very much appreciated and cultivated extensively for its valued fruit. Common in Central Luzon.
- Myristica Philippinensis*, Lam.—Anis cahoy (T.); Nuez moscada (Sp.); Nutmeg (Eng.). A tree found growing naturally in Cavite, Laguna, and Cebu Island. The fruit or nut is used as a condiment.
- Nicotiana tabacum*, Linn.—Tabaco (Sp. T.); Tobacco (Eng.). An herb, 3 to 5 feet high, of American origin, growing in Luzon and the southern islands, the best being that grown in Isabela and Cagayan. Many varieties are largely produced and exported to foreign markets. The leaves are used for making cigars, cigarettes, etc.
- Nipa fructicans*, Wurmb.—Nipa (Sp. T.); Sasa (T.). A marsh plant, one of the most useful trees, growing throughout the archipelago. The sap or "tuba" is largely used for making wine and alcohol; the leaves for roof making, etc. The tuba when much fermented may be used as vinegar.
- Ochrocarpus pentapetalus*, Blanco.—Pamitlain, Pamitlatin. A tree growing in north-western Luzon. The seeds yield an oil used for illuminating purposes.
- Oryza sativa*, Linn.—Humay; Palay (T.); Arroz, Palay (Sp.); Rice, Paddy (Eng.). A cereal, hundreds of varieties of which are extensively cultivated throughout the archipelago. The grains especially are used for food and form a staple product.
- Pachyrhizus angulatus*, Rich.—Camas (B.); Hincamas (T.); Incamas (P. Pn.); Jincamas (T.); Kamas (Il.); Sincamas (T.); Ticamas (V.); Yam bean (Eng.). An herbaceous vine grown to a large extent in Luzon, etc. The tuber is eaten raw or cooked.
- Parkia roxburghii*, G. Don.—Cupang. A resin useful for illuminating is extracted from this plant.
- Phalaris canariensis*, Linn.—Alpiste (Sp.); Canary Grass, Canary Seed (Eng.). A grass grown rather for ornament in Abra, Ilocos Norte, and Ilocos Sur. The grain is used for feeding canary birds.
- Phaseolus*, Sp.—Agayac (C.); Agayap (T. Pn.); Beans (Eng.). Beans found in Cagayan; raised in small quantities for local use.
- Phaseolus lunatus*, Linn.—Azabache, Zabache (T.); Frijoles (Sp.); Beans (Eng.). A vegetable found in Batangas and other places, though it is rarely cultivated. The fruit is used for food.

- Phaseolus lunatus inamænus*, Linn.—Patane (T.); Sieva or Civet Bean (Eng.). A climbing plant growing on Luzon and Panay islands, etc. The seeds are used as an article of food for local consumption.
- Phaseolus mungo*, Linn.—Balatong, Mungo (T.); Mongo (Sp.). An herb, 3 feet high, grown on a commercial scale throughout the archipelago. The seed constitutes an article of food and is a staple product.
- Phaseolus vulgaris*, D. C.—Butinga (T. P.); Habas (Sp. T.); Beans (Eng.). A vegetable raised for local consumption only in Batangas and Pampanga.
- Phyllanthus distichus*, Mull.—Bangquiling (T.); Iba (T. P.); Layohan; Paras (V.); Otaheite Gooseberry (Eng.). A tall shrub or small tree, about 20 feet in height, grown in gardens. The fruit is used for pickling and preserves and is sometimes eaten raw.
- Pinus insularis*, Endl.—Affords resin used for lighting. Found in Luzon.
- Pinus mercusii*, Jungh.—A tree producing a resin used by Igorrotes for illuminating purposes.
- Piper betle*, Linn.—Ikmo, Itmo (T.); Mam-in (P.); Mamon (V.); Samat (P.); Buyo (Sp.); Betle (Eng.). A climbing plant found in Luzon and other islands. It is raised to a large extent in Pasay, Rizal Province, and some other places. The leaves are used for chewing only, together with a piece of betel nut and a bit of lime.
- Piper nigrum*, Linn.—Malisa (P. Il.); Paminta, Pimenta (T.); Pimienta (Sp.); Black Pepper (Eng.). A shrub growing in Luzon and Panay islands, though rarely cultivated at present. Formerly extensively grown in Batangas. The fruit is used as a spice.
- Pisum sativum*, Linn.—Chicharo (T. Sp.); Guisante (Sp.); Peas (Eng.). A tendril-climbing herb, grown as a garden vegetable in Batangas, Bulacan, etc.
- Pithecolobium dulce*, Benth.—Camachile (T.); Camanchile (T. Il.); Camansile (T.); Damortis (Il.). A tree, 25 to 40 feet in height, found on Luzon Island, having been introduced from America. It grows spontaneously and the fruit is edible. The bark is used for tanning purposes, and charcoal made from the wood is used in manufacturing gunpowder.
- Portulaca oleracea*, Linn.—Ansiman, Colasiman (T.); Olasiman, Verdolaga (Sp.); Purslane, Pusley (Eng.). A trailing weed found throughout the archipelago, but not cultivated. The stem and leaves are edible and are used as a salad.
- Psidium guajava*, Linn. var.—Bayabas, Tayabas (T.); Guayava (Sp.); Lemon guava (Eng.). A tree or shrub, 10 to 20 feet high, of American origin; found throughout the Philippine Islands. The fruit is valued for making jellies and preserves, and is used both locally and commercially.
- Psophocarpus tetragonolobus*, D. C.—Calamismis (T.); Camaluson (V.); Kalamismis (T.); Pal-lam (Il.); Pallang, Seguidillas (T. Sp.). An herbaceous vine grown as a garden vegetable. It is found in Luzon and Panay islands, and grows wild in some places. The young pods are used for a condiment, salads, etc.
- Punica granatum*, Linn.—Dalima (J.); Granada (Sp. T.); Pomegranate (Eng.). A shrub, about 10 feet high, found in Luzon, Jolo, etc. The fruit is edible, but the shrub is planted in gardens rather for ornament.
- Raphanus sativus*, Linn.—Labanos (T.); Rabano (Sp.); Radish (Eng.). A vegetable grown to a large extent throughout the archipelago. The root is edible.
- Rhamnus* Sp.—Cabatete (Il.); Cabatiti (Il. Pn.). A shrub, 9 to 12 feet high, found in Nueva Vizcaya. Very seldom used, though the leaves are edible.
- Rhizophora mucronata*, Lam.—Bakao, Bakawan (T.); Mangle (Sp.); Mangrove (Eng.). A small tree growing in mangrove swamps throughout the islands. The bark, fruit, etc., are utilized for dyeing and tanning purposes. The wood is much used as firewood.
- Ricinus communis*, Linn.—Lansina, Linancina; Tangantangan (T.); Palma Cristi, Ricino (Sp.); Castor Oil plant (Eng.). A shrub growing spontaneously nearly all over the islands of Luzon, Visayas, and Mindanao, forming dense jungles. The seeds yield an oil much prized in commerce.
- Saccharum officinarum*, Linn.—Tubo (T.); Caña dulce (Sp.); Sugar cane (Eng.). A tall grass, 8 to 15 feet high, several varieties of which are extensively cultivated throughout the archipelago, especially in Pampanga and Negros. Sugar made from the juice of the stalks forms a staple product, being largely exported.
- Sandoricum indicum*, Cav.—Santol. A tall tree grown in gardens throughout the archipelago. Valued for its fruit, which is utilized for dessert, preserves, etc.
- Sesamum indicum*, Linn.—Linga (T.); Ajonjoli (Sp.); Sesame, Beneseed, Gingelly, Til or Teel (Eng.). Two varieties of this important herb are raised in small quantities upon Luzon and other islands. The seeds are used for making oil and seasoning soups, pastries, confections, etc.

Sesbania grandiflora, Pers.—Catoday (Il.); Catuday (T. Il.); Caturay (P. Il.); Katurday (Il.). A native tree, 20 to 30 feet high, growing in Luzon. The flowers are used for salad, etc., and the resin medicinally.

Sesuvium portulacastrum, Linn.—Bilang bilang (V.); Carampalit (P.); Dampalit (T.); Tarumpalit. A succulent branching herb, found in Luzon and other islands. The stems and leaves are used as a vegetable, especially for pickling.

Setaria italica, Beauv.—Bicacao (V. T.); Bucacao (Il.); Mijo (Sp.); Millet (Eng.). A cereal found in Luzon, Cebu, etc., though rarely cultivated. The grains constitute an article of food.

Sinapis brassicata, Blanco.—Pechay (T.). An herb grown as a garden vegetable in Luzon and other islands. The leaves are used.

Sinapis juncea, Blanco.—Mostaza (Sp. T.); Mustard (Eng.). A vegetable growing in the gardens throughout the archipelago. The leaves and seeds are used for condiment, etc.

Solanum melongena, Linn. var.—Talong (T.); Berengena (Sp.); Egg Plant (Eng.). An herb, 3 feet high, cultivated as a garden vegetable, for local consumption only, throughout the archipelago.

Solanum tuberosum, Linn.—Batata (T.); Papa, Patata (Sp.); Potato, Irish Potato (Eng.). A vegetable of American origin, found in Luzon and other islands. It is raised to a considerable extent in Benguet. The tuberous root is used as an article of food.

Sorghum saccharatum, Moench.—Batad (V.); Batag; Sorghum (Eng.). A grass found in Iloilo, Masbate, Abra, etc., though rarely cultivated. The stem yields sugar; and the roots and seeds are also utilized. Alcohol can be obtained from this plant.

Tacca pinnatifida, Forst.—Canobong (V.); Panarien (Pt.); Parnarien (Il.); Tayobong (V.). A shrub, 6 feet or more high, cultivated in Antique, and very common in Ilocos and Zambales. The tuberous root is utilized in making a flour called "gaogao," sold in the Manila markets.

Tamarindus indica, Linn.—Samalagui, Sambag, Sambagui, Sambalagui (V.); Sampaloc (T.); Tamarindo (Sp.); Tamarind (Eng.). A tall tree, about 30 feet or more in height, grown to a limited extent in Luzon, the Visayan Islands, etc., and valued for its fruit, the meat of which is edible and serves for making preserves, sirup, dressing, etc.

Terminalia catappa, Linn.—Dalisay, Talisay; Almond (Eng.). A tree, 30 to 40 feet high, growing spontaneously throughout the archipelago. The seeds are edible and are known as native almonds.

Theobroma cacao, Linn.—Cacao (Sp. T.); Cocoa (Eng.). A shrub or small tree of great importance found throughout the archipelago, introduced from America in the sixteenth century. It is grown to a large extent and the fruit is edible. The seeds are used for making chocolate. Large quantities of cacao of excellent quality are produced in southern Mindanao and district of Davao.

Triphasia trifoliata, D. C.—Limon suti. A shrub, growing spontaneously in Jolo, Mindanao, Luzon, and Panay. The fruit is used for dressing, etc.

Triticum vulgare, Willd.—Trigo (Sp.); Wheat (Eng.). A cereal grown in Batangas, Cagayan, Cavite, and Ilocos Norte, though rarely planted at present. The grain is used for making flour, which is made into bread.

Vatica mangachapuy, Blanco.—A tree of medium size, which yields resin.

Vitis Sp.—Úvas (Sp.); Grape (Eng.). A vine raised or planted in gardens in Albay, Ilocos Norte, etc., but rather for ornament than for fruit. The fruit is, however, used.

Zea mays, Linn.—Mais (T.); Maiz (Sp.); Corn (Eng.). A cereal introduced from America, many varieties of which are cultivated throughout the archipelago. The grains are utilized for food, being a staple product.

Zingiber officinale, Linn.—Baseng (Il.); Loyal (M.); Luya, Luy-a; Pangas (M.); Jengibre (Sp.); Ginger (Eng.). A vegetable grown in Luzon and other islands for local consumption. The tuber or root is the part used for dressing or as a spice.

Zizyphus jujuba, Lam.—Manzanitas (Sp. T.). A tree, planted in gardens in Cavite, Ilocos Norte, etc., yielding an edible fruit.

NOTE.—B., Bikol; C., Cagayan; Il., Ilocano; J., Jolo; M., Mindanao; P., Pampanga; Pn., Pangasinan; T., Tagalog; V., Visayan; Z., Zambales.

EXHIBIT B.

AGRICULTURAL CONDITIONS RELATIVE TO VALUE OF LANDS, WAGES OF FARM LABORERS, PRINCIPAL CROPS, ETC., IN THE PROVINCES.

Many letters have been received by the bureau requesting information as to the availability and prices of lands, the wages of farm laborers, and the principal crops in the various provinces, presumably with the view of making investments. In order to answer our correspondents intelligently, a circular letter of inquiry was addressed to officials in the provinces covering the points in question, and, as there appears to be a general demand for information along these lines, the replies so far received are here presented in full.

PROVINCIAL GOVERNMENT OF PANGASINAN.

LINGAYEN, *July 14, 1903.*

SIR: In reply to your circular letter of July 10, 1903, I have the honor to inform you as per your notations.

First. Relative to private lands which might be obtained by purchase and the price per hectare.

In answering this question, it will only be necessary to consider cultivated land as divided into two general classes; that is, rice land and sugar land. Rice land embraces all or the major portion of the lowlands of the provinces, or land that may be easily irrigated, or is subject to inundation to a greater or less degree at certain seasons of the year. The better quality of this land may be had at prices ranging from \$150 to \$200 Mexican per hectare. The sugar land will embrace all land not subject to inundation, although much of it is susceptible to easy irrigation. This class of land may be purchased at from 100 to 150 pesos per hectare. Uncultivated land, whether high or low, that will bear the distinction of arable land, may be bought for 25 to 50 pesos per hectare. I will state, in this connection, that prices in general for land here seem to be based rather more upon the financial necessity of the owner than upon the real natural value of the land itself. However, the price given will, I think, be found to represent the average prevailing at this time.

Second. What are the wages usually paid ordinary farm laborers?

The farm laborer does not receive a wage, in the usual sense as we use it. All agricultural work is done on the share-and-share system. The large land owner sometimes advances money to his laborers, but rather more frequently his advances are confined to the food required by the laborer and his family. When the crops are harvested these advances are returned from the portion of the yield belonging to the laborer, which constitutes his hire. I am told that if one were to attempt to hire labor of this class it would be necessary to pay 50 cents Mexican per day and food in addition.

Third. What are the principal money crops, and could these crops be advantageously increased?

The principal money crops of this province are rice, sugar, nipa, corn, indigo, cocoa, and tobacco. Under certain conditions these crops could be enormously increased.

Your fourth question, "Can you give an estimate of the amount of income derived from the crops at the present time?" is rather a difficult one to answer. There are no statistical data to base an estimate upon, but from the best information obtainable I would say that the products of the soil in this province are yielding at this time an annual income of from 8,000,000 to 10,000,000 pesos.

Fifth. What obstacles, if any, must be overcome in order to secure larger crops or greater agricultural activity?

This question is a broad one, and I am afraid I can do it but poor justice. Larger crops, in the initial sense, could be secured if there were more labor and animals at the disposal of the planter, and naturally greater agricultural activity would follow; but if the best results are to be obtained and land already under cultivation brought to a higher state of efficiency methods must be changed, and here is where the deepest water and the most obstinate opposition will be encountered. Just now the most depressing local conditions are the scarcity of animals and the abundance of locusts, and, perhaps, after all, if these obstacles were removed, conditions might be so improved as to bring the solution of the greater problem at least within the bounds of a possibility.

Respectfully,

C. F. VANCE, *Provincial Supervisor.*

Prof. F. LAMSON-SCRIBNER,
Chief Bureau of Agriculture, Manila, P. I.

PROVINCIAL GOVERNMENT OF PANGASINAN.

LINGAYEN, *August 14, 1903.*

SIR: In reply to your letter of the 10th ultimo, I have the honor to send you the following information:

1. It is believed that private lands can be purchased here at the price of \$50 to \$100 Mexican per hectare.

2. Laborers' wages are 50 cents a day.

3. The most profitable crops in this province are rice in the first place, and tobacco, sugar-cane, and cocoanuts in the second, all of which could be advantageously increased.

4. It is estimated that rice is grown at a profit of 15 per cent, and that 15 per cent to 20 per cent is obtained from the production of other crops.

5. At present, the greatest obstacle to be overcome is the lack of draft animals and the swarms of grasshoppers.

The above information has not been furnished earlier on account of having to await reports from the several towns of this province.

Respectfully,

M. FAYLA, *Provincial Governor.*

Prof. F. LAMSON-SCRIBNER,

Chief Bureau of Agriculture, Manila, P. I.

PROVINCIAL GOVERNMENT OF ALBAY.

ALBAY, *July 22, 1903.*

SIR: I am in receipt of your circular letter of the 10th instant, requesting certain information and, in reply, have the honor to state the following in answer to your questions:

1. Fully 80 per cent of the male adults of this province are landowners. This land can be bought by purchase, the price varying from \$5 to \$200 Mexican per hectare.

2. The average wages paid for day labor varies according to the class of labor; the ordinary day laborer receives 1 peso per day; carpenters, \$2.50; stone masons, \$2; hemp workers are compensated by receiving one-half of the amount of hemp fiber they produce per day, this varying from 4 to 8 pesos per day—that being the portion due to the laborer.

3. The principal crops of this province are hemp, copra, and rice.

4. During the past year the province produced in the neighborhood of \$12,000,000 Mexican worth of hemp; copra, in the neighborhood of \$1,000,000. Rice—this crop was very short, owing to the lack of carabaos. The present year, however, at least one-third of the sementeras (rice lands) of the province have been put under cultivation.

5. The greatest obstacle in this province at present to the increasing of the present output of its products is the lack of labor, there being many thousand acres more hemp under cultivation than there are laborers to extract the fiber. Labor and transportation are the two great drawbacks in the province.

Trusting the above is the information desired, I remain,

Respectfully,

A. U. BETTS, *Governor.*

Prof. F. LAMSON-SCRIBNER,

Chief Bureau of Agriculture, Manila, P. I.

PROVINCIAL GOVERNMENT OF ANTIQUE.

SAN JOSE, *July 27, 1903.*

SIR: In reply to your letter dated July 10, 1903, I have the honor to give you the following information regarding Antique Province:

First. Private lands can be obtained in almost any quantity at from \$50 to \$150 Mexican per hectare.

Second. Ordinary farm laborers are generally paid from 20 to 30 cents Mexican per day.

Third. The principal money crops in this province are rice, sugar cane, and some hemp.

Fourth. I am unable to give you an estimate of the amount of income derived from these crops, but will state that the profits are very good.

Fifth. The only obstacles that I know of to be overcome in order to secure larger crops are the scarcity of work animals and the lack of improved farm implements. The soil seems to be especially adapted to the culture of rice and sugar cane, though

stock raising would be a profitable business on account of the vast grazing lands throughout the province.

Respectfully,

B. F. REAMY, *Supervisor-Treasurer.*

Prof. F. LAMSON-SCRIBNER,
Chief Bureau of Agriculture, Manila, P. I.

PROVINCIAL GOVERNMENT OF BATAAN.

BALANGA, *July 28, 1903.*

SIR: In reply to your letter of July 10, I have the honor to reply as follows to the various questions:

First. Yes; from \$100 to \$280 local currency per hectare. Many are anxious to sell at this time on account of the land tax, locusts, and other causes.

Second. Fifty cents local currency per day, without board; with board, 40 cents local currency.

Third. Sugar and rice. Improperly called "money crops," as not enough is produced for home consumption. In former times, however, large quantities of sugar were sold.

Fourth. Practically none sold outside of the province.

Fifth. Natives claim that there is a lack of carabao. However, except in one or two towns of the province, there are plenty of animals for present needs. I have never had any trouble in getting carabao carts for road work at from \$1 to \$1.50 local currency per day. In my opinion, there is a great need of capital in order to revive the agricultural interests. Many who would work have no capital for the necessary outlay to plant and gather the crop.

The general use of new seeds would materially aid those who plant at present corn, sugar cane, and new rice.

Respectfully,

C. D. WOOD, *Supervisor.*

Prof. F. LAMSON-SCRIBNER,
Chief Bureau of Agriculture, Manila, P. I.

PROVINCIAL GOVERNMENT OF BENGUET.

BAGUIO, *August 3, 1903.*

SIR: In answer to your letter of July 10, 1903, I have the honor to make the following replies:

First. There are no private lands in this province worth mentioning which could be obtained by purchase; Benguet is almost entirely government land.

Second. There are no farm laborers; every man cultivates his own land, with the aid of his servants, if he happens to have any; they could hardly be called farm laborers.

Third. The principal money crops of this province consist of only coffee and potatoes.

Fourth. Ten thousand dollars Mexican is a fair estimate of the income derived from these crops at the present time.

Fifth. The only obstacle to overcome in order to secure larger crops is transportation.

Respectfully,

WM. F. PACK, *Governor.*

Prof. F. LAMSON-SCRIBNER,
Chief Bureau of Agriculture, Manila, P. I.

PROVINCIAL GOVERNMENT OF BOHOL.

TAGBILARAN, *July 29, 1903.*

SIR: In answer to your communication of July 10, I have the honor to report:

1. That there are private lands in this province which can be bought at about \$15 Mexican per hectare.

2. The wages paid farm laborers are 10 cents to 20 cents Mexican per day, with board.

3. That the principal crops at present are abaca and copra, and that rice, cotton, coffee, cocoa, sugar, and tobacco could be raised in addition.

4. That I can not give an estimate of the income derived from the various crops.

5. That the difficulties to farming at present are the billions of locusts, which breed undisturbed in the grassy plains of the northern part of the province, lack of draft animals, lack of good irrigation system, lack of good roads connecting the interior with the coast, and the very antiquated methods of farming in the province.

Respectfully,

JACOB C. MULDER, *Supervisor.*

Prof. F. LAMSON-SCRIBNER,
Chief Bureau of Agriculture, Manila, P. I.

PROVINCIAL GOVERNMENT OF ILOILO.

ILOILO, July 16, 1903.

SIR: In reply to your circular of July 10 would say:

1. There are plenty of private lands in this province that can be bought at the present date. The price of the same will be according to the class of land. If it is first-class sugar land or first-class rice land it will sell on an average of \$40 gold per hectare between the natives; but if a person from the outside tries to buy, the price is generally higher. The people class the land as to number of times it has to be plowed and its location to river and elevation. That which is near a river, where the river can overflow its banks and leave the rich deposit on the land, is the first class. Then that which has to be plowed a number of times are the other classes. Finally, the last is that which they call grazing land, and they value it at about \$5 gold per hectare. Prices between the first and last classes vary from the first price given to the last.

2. As far as I know the wages paid on the haciendas here are \$1, local currency, per week and a place to live and two rations a day. That is the general rate, but there are some who pay less.

3. The principal crops here are sugar, rice, and tobacco, and a little hemp. They could be advantageously increased a great deal.

4. I can not give you any information regarding this question, as I would be very greatly in error, and would not make a statement.

5. The obstacles to be overcome to secure larger crops or greater agricultural activity are many. The native must do more work than he does. He must be taught the difference between plowing with a stick and plowing with a plow, which will uproot the weeds and give the sun a chance to kill them. Draft animals must be kept in the province, instead of being shipped out all the time. Brigandage retards the cultivation of the country, as a man must live in the town and go to his little ranch every day and return where he can have some degree of safety. From my observations, the natives have very little idea of the cultivation of the products. Knowing how to cultivate them and using farming implements of the right kind, the crops could be doubled easily.

I should judge that at least 50 per cent of the cultivable ground of this province is idle. This from shortage of draft animals.

Respectfully,

E. S. WHEELER, *Supervisor.*

Prof. F. LAMSON-SCRIBNER,
Chief Bureau of Agriculture, Manila, P. I.

PROVINCIAL GOVERNMENT OF ISABELA.

ILAGAN, August 18, 1903.

SIR: I have the honor to reply as follows to your letter of July 10, 1903, in reference to lands, crops, etc., in this province, answering the questions in the order in which you present them:

First. There are large lots of private lands in Isabela which may be bought at from \$20 to \$40, United States currency, per hectare, depending upon location; i. e., whether overflow land, on which tobacco best grows, or land higher up, suited to corn, etc. Titles are very unsatisfactory, however, owing to the former system of registration.

Second. There is scarcely such a thing as hired farm labor known in the province. Each family owns a small tract of ground and raises its crop of tobacco and maize or works the lands of individuals or companies on shares. The province pays 50 cents Mexican per day at present for ordinary labor, but this is for a better class of men than the average, and the price is considered high.

Third. The only money crop is tobacco. Every family in the province raises it, and the trouble about increasing the output is shortage of labor. Vast tracts of valuable private lands are lying idle for want of tenants, to say nothing of the state lands that could be taken up were they needed. It is safe to say that Isabela Province could support five times the present population without difficulty.

Fourth. The approximate value of the tobacco crop of Isabela is \$1,000,000 local currency per year.

Fifth. The crying needs of the Cagayan Valley are labor and transportation. It is believed that with transportation labor would rush in, and the early construction of a railroad from Manila to Aparri would develop one of the most valuable sections of the Philippines.

Respectfully,

N. B. STEWART, *Supervisor-Treasurer.*

Prof. F. LAMSON-SCRIBNER,
Chief Bureau of Agriculture, Manila, P. I.

PROVINCIAL GOVERNMENT OF LAGUNA.

SANTA CRUZ, *August, 18, 1903.*

SIR: I have the pleasure to reply to your official letter dated the 10th ultimo, as follows:

1. There are plenty of agricultural lands in this province, but they can not be purchased, for the owners prefer to have their money invested in land in preference to having it invested where the gain is doubtful and where it is not so safe. Most of the people of Laguna are landowners and are interested in agriculture.

2. Laborers are paid in the following manner: On cocoanut plantations it is customary for the laborers to receive one-fifth of the crop in payment of their work. In the case of sugar cane, abaca, rice, and others of minor importance, laborers receive only one-fourth of the crop; but as a rule his share amounts to one-fifth of the yield.

3. The principal crops of this province are as follows: Cocoanuts, copra, sugar cane, rice, abaca, and others.

The yield of sugar cane and rice, which are the most valuable agricultural products of this province, has not been so large during these last three years as formerly, on account of the lack of animals, this preventing a great number of lands from being cultivated. The cocoanut and abaca plantations have not suffered so much, for they can be planted and kept under cultivation without animals.

4. The yield of the crops can not be ascertained, or even estimated.

5. Lack of animals and an abundance of grasshoppers, which play havoc with the plantations, are the principal obstacles to be overcome. When the farmers have acquired possession of more animals, and grasshoppers have disappeared through the cooperation of the people and local authorities, the agricultural conditions of this province will undoubtedly improve rapidly.

Respectfully,

JUAN CAILLÉS, *Governor.*

Prof. F. LAMSON-SCRIBNER,

Chief Bureau of Agriculture, Manila, P. I.

PROVINCIAL GOVERNMENT OF LAGUNA.

SANTA CRUZ, *July 16, 1903.*

SIR: In answer to your circular of July 10, 1903, I have the honor to reply as follows:

1. I know of no private lands for sale in this province. Have heard rumors of lands, which are not now under cultivation because of the lack of carabaos, being on the market for sale, but can give no information as to prices.

2. I am informed that laborers receive about 50 cents Mexican per day. Where they do work by contract it is possible to earn \$1 Mexican per day.

3. The principal crops of this province are cocoanuts, hemp, rice, and sugar. Only a small part of the hemp, rice, and sugar lands are now under cultivation, the last two because of the want of farm animals.

4. No; I understand that the profit for cocoanut trees will average about 1 peso per year.

5. Supply of work animals must be increased. The people must be induced to settle and develop the hill country.

Respectfully,

DAVID A. SHERFEY, *Supervisor.*

Prof. F. LAMSON-SCRIBNER,

Chief Bureau of Agriculture, Manila, P. I.

PROVINCIAL GOVERNMENT OF LEYTE.

TACLOBAN, *August 8, 1903.*

SIR: In reply to the questions contained in your communication of July 10, regarding crops and agricultural lands in the province of Leyte, I have the honor to report as follows:

First. There are private lands which can be purchased, but it is extremely difficult to get at the prices which may be asked. The people have very little idea of the value of real property, and the prices are a matter of sentiment and not in any way based on the producing power of the land.

In talking with the presidente of Abuyog recently he stated that the price for tracks capable of producing 300 or 400 pesos worth of hemp per year was 100 pesos, but that it was not "costumbre" in his town to sell land; that is, the land originally cost 100 pesos, and that had been the price ever since, should any one ask, but no one cared to sell.

The prices used by the tax boards for estimating values for the land-tax assessments varied from 2 cents local currency per square braza for uncultivated land to 5 and 10 cents for cultivated, according to location.

Second. Most of the labor (farm) is performed on the cooperative plan, the large landholders renting their property in small holdings for a certain percentage of the produce. A store is often run in connection, at which the tenant secures all his supplies on trust until such time as the crop matures. The owner is then paid his share of the crop and generally purchases the rest.

On the provincial roads the men are paid 50 cents Mexican per day for laborers, and 1 peso per day for section bosses, but they are very hard to secure at any price. At Tacloban the day laborers secure 1 peso per day, when they can be induced to labor at all.

In the hemp districts it is extremely difficult to get day laborers, as they prefer to go into the hemp fields and work on shares. At this work a man can earn enough in one day to keep himself and family for a week or more, and is, consequently, under no obligation to work the remaining time, and does not.

Third. The principal crops are hemp, copra, and some tobacco, and all of these could be much increased.

Fourth. The annual money value of the hemp crop is estimated at from \$8,000,000 to \$10,000,000 local currency and the copra at about \$500,000 Mexican. The tobacco is almost entirely used for home consumption.

Fifth. Lack of roads from the coast to the interior, over which the produce can be marketed, offer considerable obstacle to the increase in quantity of the crops, but the main drawback is the lack of energy on the part of the inhabitants themselves. Not much is done in the way of cultivation, and the present output is mostly made up of things that happen, and is not brought about through any assistance rendered by the people to a kind Providence.

Respectfully,

S. B. PATTERSON, *Supervisor.*

Prof. F. LAMSON-SCRIBNER,

Chief Bureau of Agriculture, Manila, P. I.

PROVINCIAL GOVERNMENT OF MINDORO.

CALAPAN, *July 17, 1903.*

SIR: Replying to your circular letter of July 10, I have the honor to submit the following:

First. Yes. The highlands, without timber, formerly sold for \$2 Mexican; the lowlands at \$25. Lands planted to cocoanuts, cocoa, coffee, or hemp sold at prices agreed upon for each plant or tree.

Second. At present laborers furnishing their own tools and animals are paid 50 cents Mexican per day, with two meals. They were formerly paid half these wages.

Third. The principal money crops of the province are cocoanuts, hemp, and palay which, with cocoa, coffee, corn, and other cereals, could be considerably increased.

Fourth. It is impossible to make an estimate at this time as a result of the loss of animals and failure of crops from drought and locusts.

Fifth. The only obstacle in the advancement of Mindoro is the lack of labor. It is my opinion, in which I am supported by the influential natives of the province, that the importation of Chinese is a necessity. The entire province might properly be called virgin soil.

Respectfully,

R. J. OFFLEY,

Captain, Thirtieth U. S. Infantry, Governor.

Prof. F. LAMSON-SCRIBNER,

Chief Bureau of Agriculture, Manila, P. I.

PROVINCIAL GOVERNMENT OF NUEVA ECIIJA.

SAN ISIDRO, *July 25, 1903.*

SIR: I have the honor to reply to your communication of the 10th instant as follows:

1. According to results of the census there are private lands in "haciendas," 148,626 hectares, 89 areas, 16 centiareas; in "solares" (gardens), not haciendas, 2,821 hectares. Official taxation per hectare is assessed according to the class of land, to wit:

Class:	U. S. currency.
First	\$25.00
Second	20.00
Third	15.00
Fourth	10.00
Fifth	5.00

The "solares" are not appraised per hectare, but according to the estimates furnished by the respective owners.

2. In this province it is not customary to pay day wages to the field laborers; but 40 cents Mexican is, approximately estimated, a laborer's daily wage.

3. The principal fount of wealth in this province is agriculture, chiefly that relating to the cultivation of palay, which undoubtedly must and can undergo greater development. It is at present in a state of great depression.

4. For the present no estimate can be made of probable crops, for the reason that the majority of the farmers have been unable to plant seed beds even, owing to the backwardness of the rains. In 1902 the crop results were as follows:

Rice.....	cavans..	502,906
Corn.....	ears..	20,422,099
Tobacco.....	bales..	5,741
Sugar.....	pilones..	^a 221

Respecting crops of previous years—previous to 1902—the losses this year were 75 per cent in rice, 80 per cent in corn, 70 per cent in tobacco, and 95 per cent in sugar.

5. Besides the need of opportune rainfall, owing to a lack of irrigated lands in this province, and the complete extermination of the locusts, there is also a great shortage in working animals.

There are at present 14,821 carabaos, 25 per cent of which are useless for work. Before the war and the epizooty there were 35,000 useful carabaos. We are, therefore, in need of 23,879 carabaos to place this province in the same condition in which it was before the war and the appearance of epizooty. Before the war—that is, in the years 1890 to 1895—our crops amounted to:

Rice.....	cavans..	2,011,623
Corn.....	ears..	102,110,495
Tobacco.....	bales..	19,136
Sugar.....	pilones..	4,419

During the period of the tobacco monopoly this province yielded 200,000 bales in 1862, and in 1875 the crop was 70,800 bales.

Respectfully,

EPIFANIO DE LOS SANTOS CRISTOBAL, *Governor.*

Prof. F. LAMSON-SCRIBNER,

Chief Bureau of Agriculture, Manila, P. I.

PROVINCIAL GOVERNMENT OF PAMPANGA.

BACOLOR, August 14, 1903.

SIR: In reply to your communication of the 10th ultimo, I have the honor to inform you that I have consulted all the presidentes in this province by letter in regard to your queries; but ten have answered. The following is a résumé of information thus derived:

Private lands can be purchased in this province in the municipalities of Bacolor, Lubao, San Miguel, Candaba, Mexico, and San Fernando at from 5 to 250 pesos per hectare, according to the class and location.

Most of the laborers are tenants and work the fields on shares, receiving from one-quarter to three-fifths of the crop. Others are paid by the day, and, according to the presidentes' reports, receive from one-half to 1½ pesos per day. I think this price is excessive. I pay my road laborers 50 cents Mexican per day.

The presidentes gave me no information in regard to crops. From observation I find that sugar and rice predominate. Also small amounts of corn and indigo are cultivated.

The presidentes can give me no estimate of the values of crops.

Locusts, lack of carabao, dryness, inundations, lack of money, imperfect implements, lack of laborers, lack of irrigation, lack of regulations between proprietors and tenants, and lack of good methods of transportation seem, from the presidentes' reports, to be the chief impediments to procuring larger crops.

Respectfully,

N. P. CREAGER, *Supervisor.*

Prof. F. LAMSON-SCRIBNER,

Chief Bureau of Agriculture, Manila, P. I.

^a 1 pilon equals about 344 pounds.

PROVINCIAL GOVERNMENT OF PARAGUA.

Cuyo, July 30, 1903.

SIR: I have the honor to acknowledge receipt of your circular letter of July 10, 1903. First. I do not know of any private lands in the province for sale where the supposed owners can give a good and sufficient title for the same. One can buy the native's right to a piece of land, running the risk of ever obtaining a title for the land, for about \$10 Mexican per hectare.

Second. The price of labor varies greatly, depending upon circumstances. For example, a native will work for another native for less than for an American, because he does not have to work as hard. Labor can be obtained for from \$3 to \$5 Mexican per month, if they are not to be taken away from their homes or families. If they are to be taken away from the particular island or municipality in which they live, sometimes almost any price is necessary—at times as much as \$40 Mexican per month is necessary.

Third. The principal money crops are rice, copra, tobacco, and hemp. Many raise cattle. All of these could be largely increased if the public lands were surveyed and opened to settlement or purchase by people who will put money into land when they can obtain a good title to enough land to justify establishing a hacienda. People with money and brains are not going to put it into a 16-hectare farm; neither will they put in any improved machinery to cut 10,000 cubic feet of timber.

Fourth. Copra is about the only product except cattle where any more is produced than is used in the province. The harvest is excellent for all the crops, but there is no one here to go into it on a large scale.

Fifth. The only obstacles to overcome are labor and title to land; with these will come money and brains to use the land and labor.

Respectfully,

WM. A. PHILLIPS, *Governor.*

Prof. F. LAMSON-SCRIBNER,

Chief Bureau of Agriculture, Manila, P. I.

PROVINCIAL GOVERNMENT OF RIZAL.

PASIG, July 18, 1903.

SIR: Replying to your official letter of the 10th instant, I have the honor to advise you as follows:

1. All of the land in this province is under cultivation; nevertheless some land could be bought, especially if a good price were paid for it. A balita of workable land ordinarily costs 100 pesos. Balita is the unit of measurement here, and represents some 2,000 square meters, or approximately 20 ares. The price per hectare is some 500 pesos, more or less.

2. One to 1½ pesos is the daily wage of farm laborers, although it is not customary to pay them in money, the usual proceeding being that the laborer receives a share in the crop (or the products of the crop) from the owner or lessee of the land.

3. There are two important crops in this province, rice and sugar. There are also corn, mangoes, sweet potatoes, bananas, and other tubers no less necessities of life for the planter. All of these could be increased advantageously if there were sufficient carabaos in the province. An adequate supply of these animals is the only hope of salvation for the suffering planter and would enable him to look forward with confidence to the future for his subsistence.

4. Thirteen thousand and thirty-seven hectares 68 square decameters and 97 square meters of land yielded last year 3,154,451 cavans of rice throughout the province; 1,682 hectares 43 square decameters and 33 square meters produced in the same year 57,752,005 canes of sugar; 409 hectares 9 square decameters and 75 square meters yielded for that period 615,585 ears of corn, besides other products, such as bamboo, tomatoes, bananas, melons, watermelons, small cucumbers, ylang-ylang, cocoanuts, betel leaves, plums, sweet potatoes, tobacco in the leaf, mangoes, tamarinds, oranges, zacate, pineapples, guavas, hicasas, rosemary, mulberries, abaca, peanuts, gages, chicos, mabola, eggplant, carambola, casuy (a gum), dates, onions, coffee, cacao, nanca, bonga, santol, lomboy, rubber, papaw, radishes, and others.

5. The obstacles which it seems to me should be overcome are, first, the shortage in carabaos; then the locusts, which destroy plantings; then the small worms, which resemble the phyloxera genus and destroy sowings of rice, sugar cane, corn, and others.

Respectfully,

A. DANCEL, *Governor.*

Prof. F. LAMSON-SCRIBNER,

Chief Bureau of Agriculture, Manila, P. I.

PROVINCIAL GOVERNMENT OF SAMAR.

CATBALOGAN, *July 25, 1903.*

SIR: Referring to your letter of the 10th instant, I have the honor to answer questions asked, as follows:

1. There seems to be no demand nor market for agricultural lands in this province at the present time.
2. Ordinary farm laborers receive from 5 to 15 pesos per month.
3. The principal money crop of the island is hemp. Others that could be mentioned are cocoanuts and their productions, such as copra; a limited amount of sugar, and an abundance of fruits, principally bananas, mangoes, etc.
4. Can form no estimate of income derived from these crops.
5. Obstacles to be overcome. The war has paralyzed all industries, and an agricultural bank, such as has been proposed, that would loan money on real estate security and thus enable the people to again make a start would, I believe, prove of great help.

In addition to what has been stated in answer to No. 4, I would state that all of these crops can be materially increased, the production of the province being at a minimum and agriculture practically at a standstill.

Respectfully,

PEDRO A. CASANOVA, *Treasurer.*

Prof. F. LAMSON-SCRIBNER,
Chief Bureau of Agriculture, Manila, P. I.

PROVINCIAL GOVERNMENT OF SURIGAO.

SURIGAO, *July 23, 1903.*

SIR: In reply to your communication of the 10th instant, I beg to state the following:

1. There are private lands in this province that can be bought at the rate of 50 pesos per hectare.
2. Ordinary laborers get half a peso per day.
3. The principal crops which can be raised to a great advantage are manila hemp, copra, and rice.
4. The following are at the present time the estimated yields, viz, 85,000 piculs manila hemp, 17,000 piculs copra, and 20,000 cavans of rice.
5. In order to insure success in getting better results there should be undertaken the improvement of the present system of preparing and cultivating the land, and harvesting according to modern methods of culture or by means of improved agricultural implements.

Respectfully,

PRUDENCIO GARCIA, *Governor.*

Prof. F. LAMSON-SCRIBNER,
Chief Bureau of Agriculture, Manila, P. I.

PROVINCIAL GOVERNMENT OF TAYABAS.

LUCENA, *July 28, 1903.*

SIR: In reply to your favor of the 10th instant, I have the honor to state that, so far as I can learn, there are no private lands for sale on this coast, but that on the Pacific coast lands in limited quantities may be purchased at an average price of \$100 Mexican per hectare.

The average price for farm laborers on this coast is 50 cents Mexican per day and subsistence, or they are paid by the amount of work done. On the Pacific coast labor is obtainable only on the share system.

The principal money crops in the province are copra and hemp. As there is always a demand for these products, I see no reason why they could not be advantageously increased.

Estimated gross income from copra, \$1,050,000 Mexican per annum; no figures on hemp.

Increased facilities for transportation and an undiscovered incentive for labor would doubtless cause agricultural activity in the province.

Respectfully,

H. C. HUMPHREY, *Supervisor.*

Prof. F. LAMSON-SCRIBNER,
Chief Bureau of Agriculture, Manila, P. I.

PROVINCIAL GOVERNMENT OF ALBAY.

ALBAY, August 19, 1903.

SIR: I have delayed answering your circular letter of July 10, because I had not the information you desired, and have not until recently had an opportunity to get it. I think the following is reliable, as it was procured for me by the former supervisor of this province, who is now in business here, and is interested in this subject.

Private lands are for sale at the following prices: Rice land costs 50 to 80 pesos per hectare, well-planted hemp land near main roads 100 to 150 pesos per hectare, and hemp land not located near roads from 50 to 100 pesos per hectare.

Ordinary labor costs from 75 cents to 1 peso per day, except in Tobacco and Legaspi, the two ports, where it costs from \$1.50 to \$2 Mexican per day.

The principal crops are hemp, copra, ylang-ylang, and a little palay. Increase in hemp production depends on increase in amount of labor. There is more money in hemp than copra at this time, therefore the latter is being neglected for the former. Copra production could be greatly increased if labor was available. A great deal of rice is being raised this season, but under normal conditions very little is planted here, because the same amount of labor in hemp brings so much more revenue. About 200,000 bales of hemp (2 piculs to the bale) is the present hemp output of this province per annum, valued at about \$8,000,000 Mexican. The output of copra is worth about \$500,000 Mexican per annum and is steadily increasing.

The principal thing needed to increase the agricultural production of the province is more labor, more and better roads, and better facilities of communication. The roads are being rapidly and steadily improved, and when these are in good shape I hope to see new ones opened up. I think the general prosperity of the province depends more on good roads than any other one thing. Next to good roads labor is the most important requisite.

It will afford me pleasure to furnish you any information that I can with regard to the resources of this province.

Respectfully,

W. A. CROSSLAND, Jr., *Supervisor.*

Prof. F. LAMSON-SCRIBNER,
Chief Bureau of Agriculture, Manila, P. I.

PROVINCIAL GOVERNMENT OF BULACAN.

MALOLOS, September 1, 1903.

SIR: I have the honor to acknowledge receipt of your circular letter of July 10 and to reply as follows:

1. Yes; and the price varies, according to the class of soil, from \$25 to \$500 Mexican per hectare.

2. Plowmen are paid 1 peso, and sowers 25 cents Mexican per day.

3. Rice, sugar, corn, sweet potatoes, gabi, and tobacco. The production of these crops could be increased by the use of modern farm implements and irrigation.

4. It is impossible to estimate the value of the crops raised owing to the scarcity of rain in this latitude, this fact having caused much despair among the planters.

5. The lack of working animals and scarcity of rain (as already stated) are the chief obstacles to be overcome in order to obtain larger crops and excite agricultural activity in this province.

It is recommended that there be installed pumping engines, artesian wells, or ditches to furnish sufficient irrigation for the land, that uniform agricultural activity may be maintained and abundant crops assured.

Respectfully,

PABLO TECSON, *Governor.*

Prof. F. LAMSON-SCRIBNER,
Chief Bureau of Agriculture, Manila, P. I.

PROVINCIAL GOVERNMENT OF CAGAYAN.

TUGUEGARAO, August 10, 1903.

SIR: In answer to you letter of July 10 would state:

First. There are private lands that can be bought in this province ranging from \$10 to \$250 Mexican per hectare. It is a hard matter to buy land, but it can be done with a little patience.

Second. Laborers are paid 40 cents to 80 cents Mexican per day.

Third. Tobacco, corn, rice, nipa; these are the principal crops in the order named. Coffee and cacao grow well, but not much has been done with them; there are great

possibilities here in these two lines. About all the land suitable is now held by the government. Tea and Peruvian bark could be grown here; the latter is now grown in the province, but its value is not understood. Agriculture, with the exception of tobacco, is nearly at a standstill in this province.

Fourth. I am unable to give an estimate of the income derived from crops.

Fifth. The great trouble is to get the natives to work; they do not understand the production of anything but tobacco and corn. Very poor corn is produced; new seed is needed in all lines, the best always being used for consumption and the poorest for seed. Potatoes and other vegetables would do well here. The fact that good profits can be made from the lines now neglected must be proved by example before the people will take hold. Labor is the great stumbling block.

Respectfully,

WM. E. PEARSON, *Supervisor.*

Prof. F. LAMSON-SCRIBNER,

Chief Bureau of Agriculture, Manila, P. I.

The following in regard to labor contracts, translated from the Boletín Oficial Agrícola de Filipinas of July 31, 1895, is of interest in this connection:

PRINCIPAL CLAUSES IN CONTRACTS OF LEASE AND PARTNERSHIP COMMONLY EMPLOYED
IN THE PROVINCE OF NEGROS OCCIDENTAL.

In this island the farmer is not always a landowner; he is sometimes a lessee, and often a partner. Contracts of partnership and lease are as diversified as the different cases to which they are applied.

Sometimes estates provided with buildings, machinery, agricultural implements and stock sufficient to conduct the work properly are let for one-third of the gross product; that is, the owner delivers the estate in working condition and the lessee contributes the necessary annual capital and intelligence. The gross product is divided into three equal parts, one of which goes to the proprietor and two to the lessee. Contracts of this kind were justified in past years by the price of sugar, which was sufficiently high to enable the lessee to cover expense of cultivation and obtain an appreciable return. Whenever the price of sugar suffered any considerable reduction the contract clauses were so modified as to allot to the proprietor no more than a fourth or a fifth of the gross product.

This class of contract presents one difficulty, which is that there is no guaranty to the proprietor of natural fertility of the land; for, in the absence of special clauses to fix the number of hectares which should be cultivated, the fertilizers to be applied or the cultivation to be given to the soil, the lessee must use his own discretion in these matters. As a consequence, he is likely to impoverish the soil in a few years. Some estates are leased at a fixed and determined cash price, the average rental being based upon 10 per cent of the value of the estate when supplied with all the material necessary for its exploitation.

There is a wide divergence in partnership contracts in this island. In some the partner tenants contribute nothing but brains and labor. The owner supplies a certain number of carabaos and points out a piece of land for them to cultivate for his account; he is also under obligation to advance the funds with which to pay the day labor absolutely necessary for cultivating the land. In harvest time these amounts are reimbursed to him, plus a certain rate of interest, which is never less than 10 per cent. The partner is charged with all expenses incident to preparation of soil, planting, cultivation, cutting the cane, and cartage to mill. Each of the contracting parties bears the expense of packing his own share of the sugar. The gross product is divided, share and share alike, between the proprietor and the lessee.

There are other contracts, according to which the partner contributes stock sufficient to work the tract of land taken in partnership; but, lacking the necessary capital, this is advanced by the proprietor, who does not usually collect interest for money so advanced. In other cases the partner puts in stock and capital sufficient for the cultivation of the land taken in partnership. He bears the expense of cutting and carting the cane, while the proprietor pays milling expenses. The gross product is divided equally between the proprietor and the partner. A sum of 6 pesos per hectare of calauan (aftermath) is generally collected as compensation for care given same, provided this crop is not the result of sowings.

Various other contracts exist which differ in form from those previously explained, though essentially they are identical. The clauses in these contracts vary according to the education and intelligence of the contracting parties.

For rice there are forms of contracts contingent upon whether or not the partner has cattle for tilling the soil. If not, the proprietor furnishes the lessee with the number of carabaos required for seeding and also some funds. All the expense of

cultivation is borne by the partner. When the gross product has been gathered the proprietor is reimbursed for the seed which he furnished, and the remainder is divided equally between the proprietor and the partner, the latter being bound to return to the former any advances made. Interest is not generally collected unless previously stipulated.

If the partner owns cattle with which to cultivate the fields, the gross product, instead of being divided equally, is divided into thirds, after the seed has been deducted. The proprietor receives one-third and the partner two-thirds.

Contracts of partnership in tobacco are very analogous to these. The proprietor always furnishes cattle for working the land, and also the seed. The partner assumes the care as well as all expenses of cultivation. The gross product is divided equally between the contracting parties. The proprietor is reimbursed from the partner's share for the funds advanced by him, the product being valued at the market price. He collects interest, which is not usually less than 6 per cent.

Abaca is generally cultivated on a partnership basis. The following is the form of contract made: It is agreed that after setting out the plantation (the expense of which is borne by the proprietor), the partner cares for the same. He elaborates the product, which is divided equally between the parties, the proprietor being reimbursed for funds advanced, in the manner already explained.

When cocoanuts are raised for the purpose of producing the alcoholic beverage called tuba, a partnership is formed. The contract is made when the tree begins to yield a return. The owner delivers the grove to the partner who, in his turn, assumes the work of collecting and selling the sweetened liquid. The amount realized from the sale of the product is divided equally between the parties.

FARM WORK LET BY CONTRACT.

Much of the farm work is let by contract—that is, the payment of a certain sum is guaranteed for a certain amount of work done. The native laborer prefers this method—not from a desire to obtain greater benefit, but in order that he may neither be compelled to work a certain number of hours per day nor six days every week, but may work when it best suits him.

The breaking of uncultivated land, the preparation of cane fields, planting of cane, and other labor required during its growth, such as weeding, covering with earth, etc., are generally let out by contract.

The cutting and carting of cane to the mill are also let by contract, the price of same being fixed per picul of sugar obtained, and not per unit of area, for the reason that a certain area may, in two different fields, yield different quantities of cane, according to the distance between plants and the number of shoots sprouted by each.

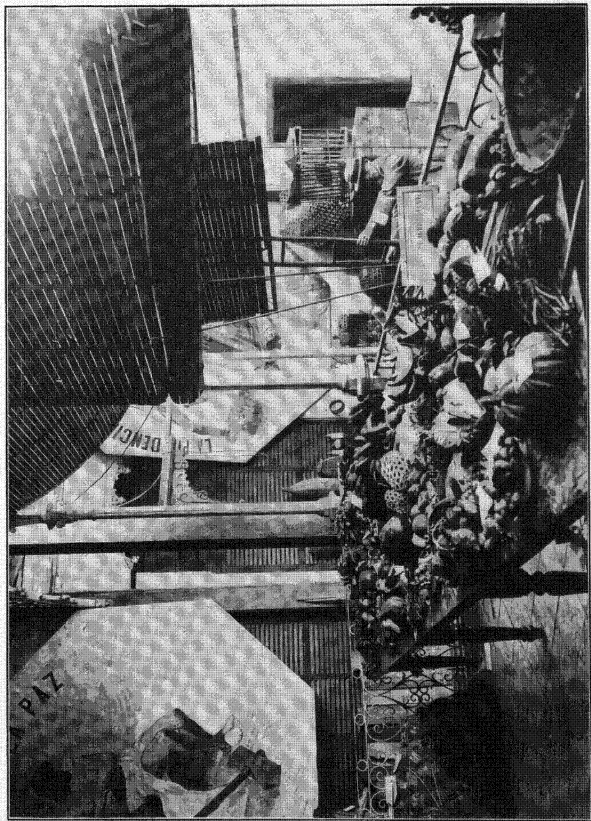
Carting the sugar to the wharves is also generally let by contract, at an average rate of 1 real (12½ cents Mexican) per picul. On some estates the grinding is also done by contract, the cost depending upon the quality and quantity of sugar.

The rice harvest is regulated by an amount which equals the third or fourth part of that gathered by the reapers, this amount varying according to the economic conditions of the year.

Wages in this island are scarcely ever paid in coin. As a rule the laborer receives for his work a certain amount in coin and the balance in kind—that is, either his food already cooked, or only the amount of palay or rice necessary for his maintenance, besides a small quantity of fish known by the name of Baligon, which he uses as seasoning for his morisquete (boiled rice), his principal source of nourishment. However, in whatever form he may receive his wages, the rate always varies according to the period of the agricultural year when the field work must be done. It may, therefore, be stated that two distinct prices exist, each of which governs during six months of the year.

In dull times—that is, when there is no cane to grind—75 cents per week, with board, is generally paid. Cane is the crop chiefly cultivated in this island, and, therefore, the one which determines the rise and fall in the rate of wages, owing to the large number of laborers required. At harvest time, especially in years when labor is scarce and every day adds to the planter's troubles, \$1.25 with board is usually paid to induce people to come from Cadiz and Antique, raising the average daily wages of a laborer to 20, 30, and even 40 cents.

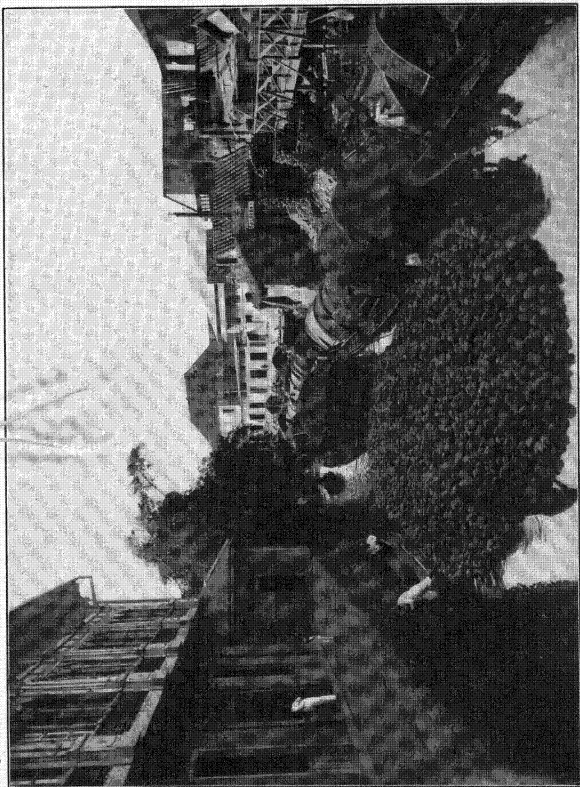
It is impossible to fix exactly the approximate amount of advances allowed to lessees, contractors, and day laborers; as, when the demand for labor is great, the farmer is compelled to advance the amount required, in order that the work may suffer no interruption. Besides, during a fortnight of work many of the laborers draw almost all of their income for the next two weeks. Notwithstanding that this is of frequent occurrence, we may say (although the figure is not very accurate) that 15 per cent of the value of the work is approximately the amount it is customary,



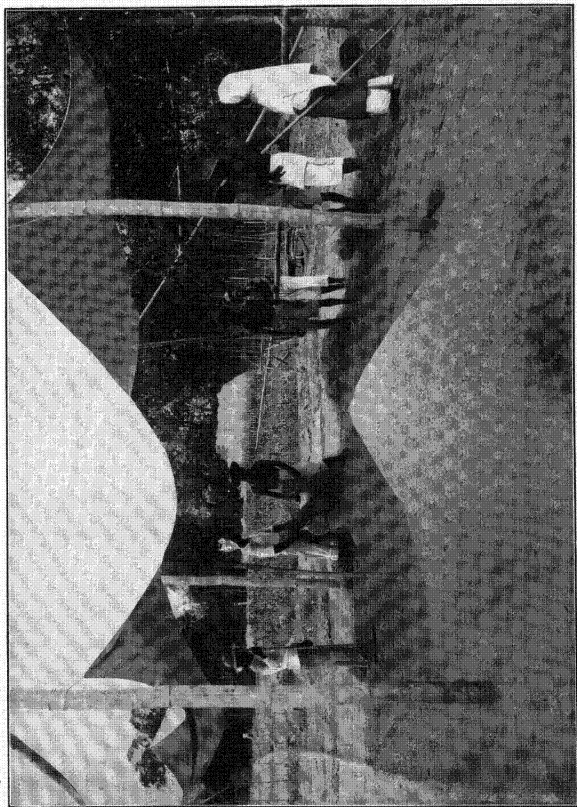
PHILIPPINE AND AMERICAN VEGETABLES.



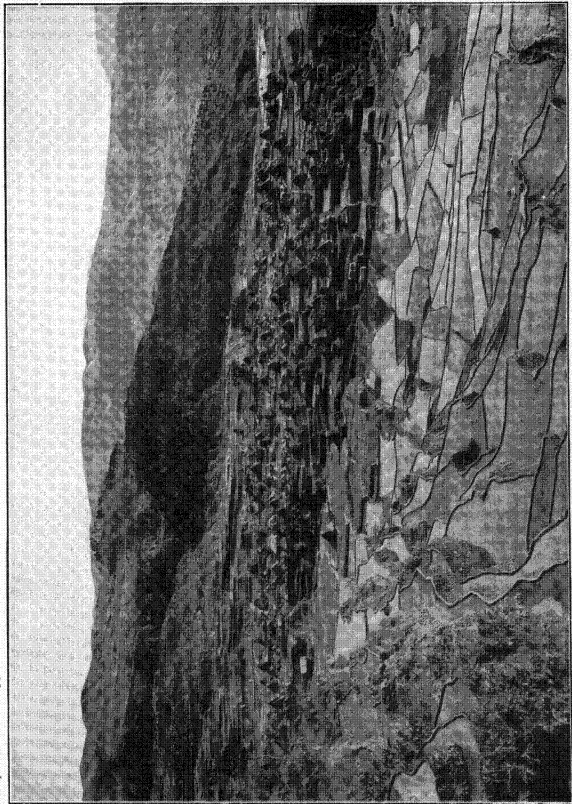
A SECTION OF EXHIBIT HELD AT MANILA FEBRUARY, 1903.



A COCOANUT RAFT FROM LAGUNA IN ONE OF THE ESTEROS OF MANILA.

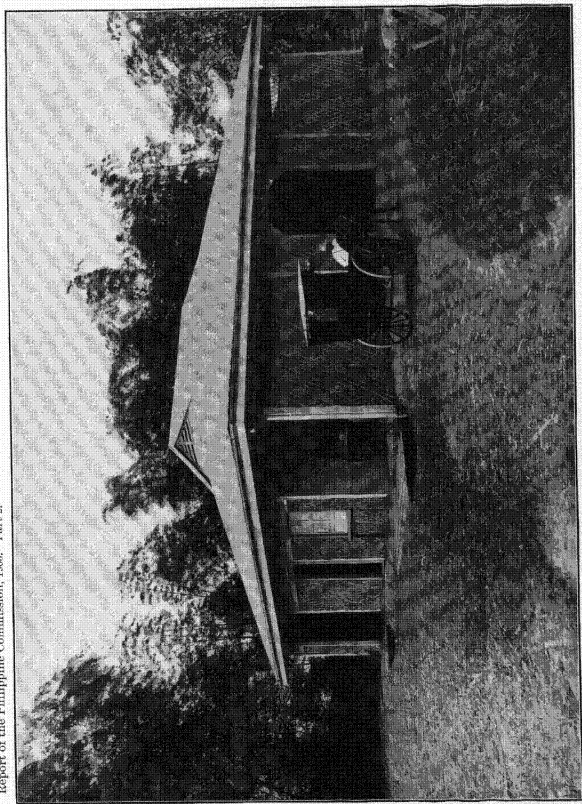


METHOD OF THRESHING RICE.

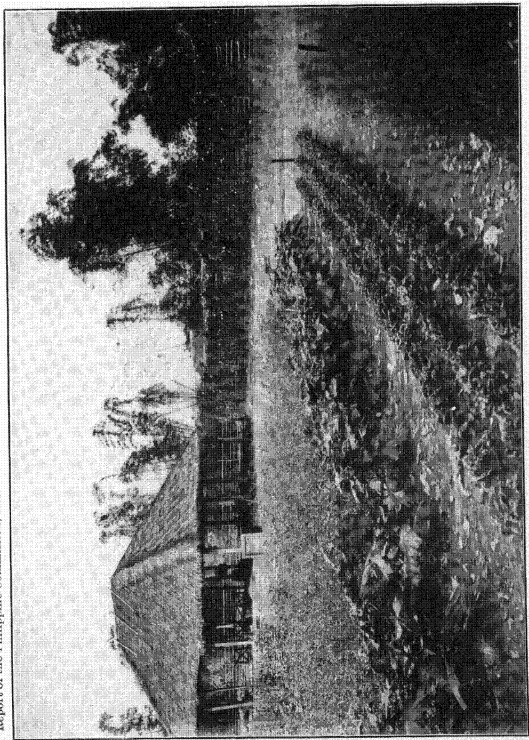


IGORROTE VILLAGE AND TERRACES FOR RICE PLANTING.

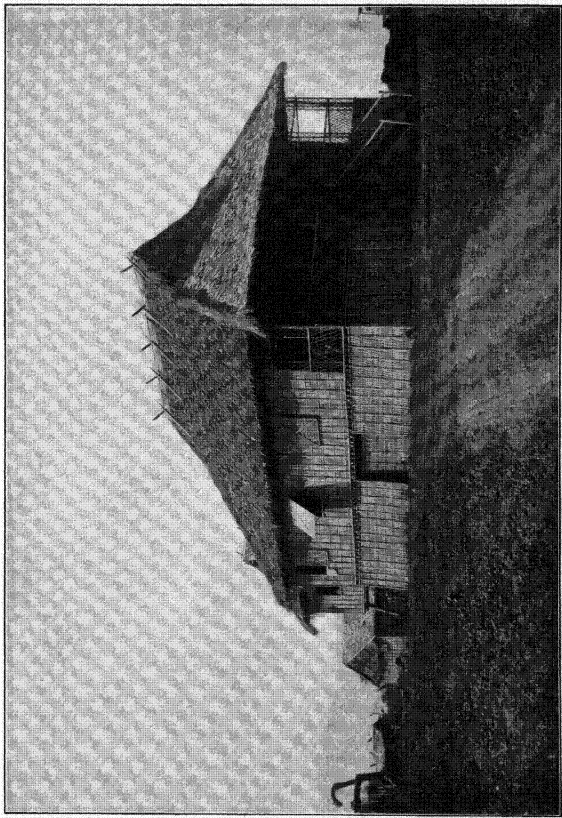




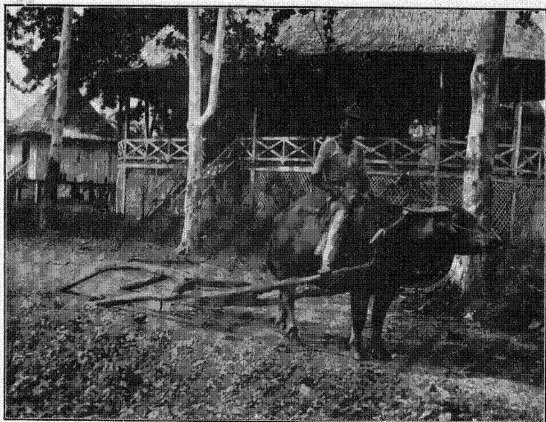
STABLE ON THE TRIAL GROUNDS OF THE BUREAU IN MALATE.



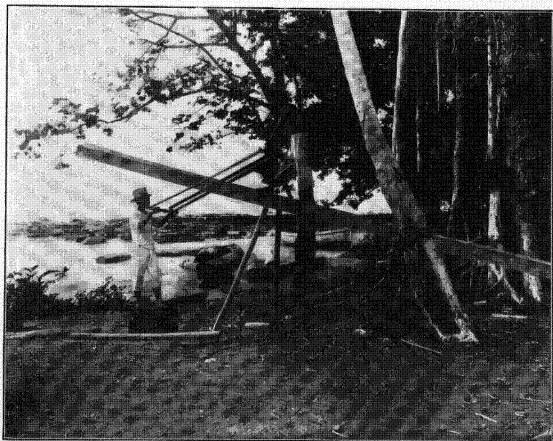
EGGPLANT AND LETTUCE ON TRIAL GROUNDS AT MALATE.



EXPERIMENT STATION AT BATANGAS. HOUSE OF SUPERINTENDENT.



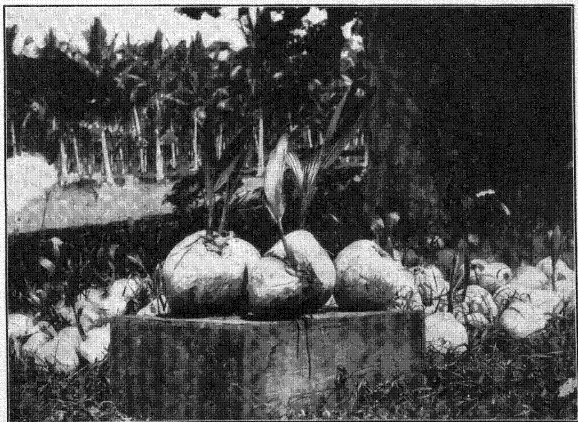
A NATIVE DRAG, SAN RAMON FARM, ZAMBOANGA.



SAWING OUT BOARDS IN NORTHEAST LUZON



PLOWING WITH CARABAO ON SAN RAMON FARM, ZAMBOANGA.



SPROUTING COCOANUTS, SAN RAMON FARM.

to advance to lessees. Interest upon sums thus advanced is not usually collected, though we know of some exceedingly rare instances, where work is conducted upon a small scale, in which a charge is made for all money advanced.

The risk incurred in advancing money for labor still to be performed, or to contractors for hiring the people needed for the work of grinding, or in meeting the continual demands of the laborers, is very great; because these laborers rarely perform the work in the time and manner agreed upon, and the contractors either do not furnish the necessary people or, if they do, half of them disappear in a short time, and, finally, the laborers are continually changing masters without repaying the funds advanced to them.

From the foregoing statements we conclude that the average risk incurred in advances—in other words, the amounts advanced for work to be performed—does not fall below 60 per cent.

F. MORENO Y SUI, *Acting Engineer Director.*

PROVINCIAL GOVERNMENT OF CAVITE.

CAVITE, *September 3, 1903.*

SIR: In answer to your letters of July 10 and August 28, respectively, I have the honor to submit the following replies herewith:

First. It has been impossible for me to secure full and positive information regarding private lands that are for sale or that may be bought. Since nearly half of the area of this province is under private ownership, salable land is probably not lacking. * * *

Second. Daily wages fluctuate between \$0.50, \$1, and \$1.50 Mexican, according to whether or not the laborers receive board and lodging, and according to the ability of the laborer and whether he furnishes implements and working animals. In the latter event he usually receives a proportionate increase for care and food for his stock. This, however, is not the method most generally pursued, the usual proceeding being to form a partnership, by the terms of which one-fourth or one-fifth of the crop is apportioned to the "aparceros" or "casamas," as these farm laborers or copartners are usually called.

Third, fourth, and fifth. The entire crop of rice in the province was and will be insufficient to supply the needs of the pueblos, and the article has been imported for some time; for this reason such laborers as receive \$1 per day prefer to take their wages in rice. With the complete extermination of locusts and the importation of working cattle sufficient to perform farm labors, the agricultural wealth of this province would soon increase considerably.

Please pardon delay in replying, as it has taken some time to secure the information, which, as you may observe, is not as complete as I should desire.

Respectfully,

D. C. SHANKS, *Governor.*

Prof. F. LAMSON-SCRIBNER,
Chief Bureau of Agriculture, Manila, P. I.

PROVINCIAL GOVERNMENT OF NUEVA VIZCAYA.

BAYOMBONG, *August 20, 1903.*

SIR: Replying to your letter of July 10, I have the honor to state that, under date of May 29, I wrote a report on the agricultural outlook, conditions, and possibilities of this province which covered most of the questions asked in your letter, and which letter was forwarded to the honorable civil governor, suggesting that it might be of interest to your department.

There are private lands which can be obtained by purchase, but there is probably not a single valid and completed title of ownership to a piece of land in the province, and out of some 70,000 hectares of land in the possession and use of natives of this province only about 1,200 hectares are registered by anyone under the former Spanish laws regarding registration of land and real property, and most of that has not gone beyond the first stage of simply registering what was claimed by the parties without submitting any proofs of ownership or proceeding to the point of a completed title for same. Titles consist of possessory rights and the boundaries are undefined in any way. Farms consist of little plots of ground in all sorts of shape and rarely exceeding more than 5 or 6 acres in a farm. There is any amount of unoccupied land on all sides, and the natives do not place much value upon the land and frequently abandon same and take up a new piece of unoccupied land, for reasons best known to themselves.

Good choice pieces of rice and garden land, including the water rights for irrigation of same, can be bought for about 15 pesos per acre if the purchaser is willing to accept

such a title as the seller is willing and able to give, which is nothing more than a receipt for the money and possession of the property.

Wages usually paid farm laborers are as follows: From 30 to 40 cents local currency per day and rice worth about 10 cents more, and the laborer takes good care to only do 30 or 40 cents worth of work, and the labor is difficult to get and not to be depended on at all.

The principal money crop in this province is rice and there are still thousands of acres of rice land unused.

The income derived from the sale of the surplus rice from this province will not exceed 100,000 pesos per year, as the population is 45,000 wild Igorrotes and only 16,000 Christians, and the people produce only enough to provide food to sustain life and enough over to sell to buy clothes and pay taxes, but as the great majority are Igorrotes, who neither wear clothes nor pay taxes, they do not have to worry about any money at all.

The principal obstacles which have to be overcome in order to secure larger crops and greater agricultural activities in this province are, first, means of transportation and communication, which can best be brought about by the building of a railroad through the heart of the island of Luzon from Manila to Aparri. There is no present means to get any products in or out of the province, and to transport farm products to the railway or to some seaport costs from 10 to 15 cents (Mexican) per pound, and you must be aware that there are few farm products which will stand such a cost for transportation as that just named.

The second necessity, provided we had the railroad, would be the introduction into this province of more energetic people, who have higher ambitions than simply existing, because the present natives of this province have no desire to accumulate wealth or acquire property provided that their doing so will necessitate hard labor and industry on their part. They seem to be absolutely happy when they have enough to eat and money enough to buy a few clothes, and having that provided for, they quit work for the rest of the year and refuse to perform any labor beyond daily household duties of cutting a little firewood, carrying a little water, and beating out the rice for the day's use.

This is not very encouraging, but it is none the less true, and we will never learn anything by deceiving ourselves, so I write you the truth as I find it.

Respectfully,

L. E. BENNETT, *Governor.*

Prof. F. LAMSON-Scribner,

Chief Bureau of Agriculture, Manila, P. I.

PROVINCE OF CAPIZ,
Capiz, September 9, 1903.

Sir: Replying to your circular letter dated August 28, 1903, I have the honor to state the following:

1. There are private lands which can be purchased, and which owners would like to sell, in view of the present condition. Prices per hectare are in accordance with kind of land—from 100 pesos for best sugar land to nothing. Considerable has been advertised to be sold for taxes but no bids received.

2. Thirty cents Mexican per day.

3. Rice, buli, tuba of nipa plant, hemp, copra, corn, sweet potatoes, and sugar; and these could be very much increased with modern methods.

4. It is impossible to estimate the amount of income at present time, as no answers were given from the municipalities.

5. The principal obstacles which must be overcome are the ancient system of cultivating and great lack of farm animals. There is great need of modern farm machines for planting, caring for, and harvesting crops, and it is believed that if such implements could be sent to a few of the towns in the province and a practical demonstration of their use be made, that as far as they are able the people would adopt them. The people are very poor and the province has suffered greatly from locust and drought. Efforts are now being made to destroy the locust and so far have seemed to meet with success, but there are enough here to cause anxiety. It is believed that enough attention is not given to the cultivation of sugar in this province. The haciendas destroyed during the war have not been rebuilt, and the large amount of capital needed to put them up anew is not in the province. As a consequence large areas of good sugar land is now unproductive. This would make a good investment for American capital.

The resources of the province are very great, and it is expected that the present state of agricultural stagnation is temporary only. This was at one time one of the

principal rice-producing provinces in the islands, but since the war enough has not been raised for its own consumption. It would be an excellent thing to bring in a few enterprising American rice farmers with proper tools for the work, to get the rice growing started again.

Very respectfully,

F. S. CHAPMAN,
Provincial Supervisor.

Prof. F. LAMSON-SCRIBNER,
Chief of Bureau of Agriculture, Manila.

PROVINCE OF AMBOS CAMARINES,
Nueva Caceres, September 4, 1903.

SIR: In reply to your circular letter of August 28, I have made inquiries and find the following:

1. There is considerable private land in this province that can be purchased. Nothing general can be stated as to price, as it varies greatly in the same locality according to the caprice of the owner. Land has been bought here recently for \$1 per acre.
2. Farm laborers are paid 50 cents Mexican per day. Most of the labor is done on shares. A very industrious laborer in the hemp district can earn \$4 Mexican per day.
3. Hemp, cacao, and rice. The rice crop has been a failure here for the past two or three years, owing to drought, pests, and scarcity of carabao.
4. No data available.
5. The main obstacles to be overcome are the following: Scarcity of carabao, drought, overcome by developing irrigation, and the people shown that much depends upon their own efforts.

Very respectfully,

EDW. S. SHUMAN,
Provincial Supervisor.

Prof. F. LAMSON-SCRIBNER,
Chief of Bureau of Agriculture, Manila.

PROVINCE OF LEPANTO-BONTOC,
Cervantes, August 1, 1903.

SIR: In answer to your letter of July 10, I have the honor to submit the following for your information:

1. Private lands in the province may be purchased for about 170 pesos per hectare.
2. Ordinary Igorrote farm laborers receive from 12 to 20 cents Mexican per day. An American could not obtain labor for less than 20 cents.
3. The principal money crops are coffee, cacao, rice, and a little tobacco. All these crops, with the possible exception of rice, could be increased.
4. Coffee will net about 80 to 100 pesos per hectare, rice 30 to 40 pesos per hectare. Of cacao and tobacco I can give you no information.
5. The difficulty of obtaining a requisite number of laborers is the chief obstacle to an increased agricultural activity. The chief difficulty in the marketing of products lies in the cost and difficulty of obtaining transportation to the coast.

Very respectfully,

M. GOODMAN, *Provincial Supervisor.*

Prof. F. LAMSON-SCRIBNER,
Chief of Bureau of Agriculture, Manila.

PROVINCE OF CEBU,
Cebu, September 7, 1903.

SIR: In reply to your letter of August 28, referring to letter of July 10, I have the honor to state that on July 28 I answered your letter and stated that in order to give accurate information I would send out inquiries from my office. Inclosed you will find a copy of the circular sent out; as yet no answers have been received.

Below are given the only answers obtainable at present:

1. Yes; prices vary according to location; average, \$100 Mexican.
2. Twenty-five to 40 cents per day of about five hours (counting rests). In working American hours 50 to 60 cents Mexican.
3. Corn, tobacco, sugar, rice, and copra, in the order named. Could all be vastly increased in both quantity and quality by use of modern methods and energy.

4. Can not tell at present. Know of one 12-acre lot that produced \$1,200 Mexican planted to corn.

5. Drought, locust pest, lack of draft animals, steady labor (natives take a rest of several days to spend savings; liable to do this in harvesting season), and a better knowledge of agricultural methods.

In addition I would like to say that a great deal could be accomplished by an experimental farm in making the 1,800 square miles and 650,000 inhabitants of Cebu more productive. There are great areas of mountain slopes which would grow grapes but which at present only grow poor crops of corn.

Very respectfully,

H. DE LANO, *Supervisor.*

Prof. F. LAMSON-SCRIBNER,
Chief of Bureau of Agriculture, Manila.

PROVINCE OF ILOCOS NORTE,
Laoag, September 20, 1903.

SIR: In reply to your circular letter of July 10, and a second of August 28, I have the honor to state that the questions asked were referred to Mr. Lallave, who is probably known to you as the best-informed man here on agricultural matters, and he informed me that he was then preparing a monograph for your information which would cover the points. He has been recently devoting himself to the extermination of the langosta and has been but seldom in Laoag for some time, and it is probably for this reason that you have not heard from him. I am able to supply you with but general information, but such as it is I am glad to put at your service.

1. I know of several large bodies of agricultural lands now on the market for sale and which could be bought for probably one-half their assessed value, which is \$60 United States currency per hectare.

2. I am securing all the labor I want on public works at 30 cents Mexican per day, and I know of no reason why landowners can not do the same. Offering a monthly wage they could probably do better.

3. The only reliable crops at present, in view of the devastation being wrought by the langosta, are maguey and tobacco. The area for the cultivation of the latter is limited, but at the present time by no means exhausted. The former is being planted in large quantities. On my last trip north it was reported to me that 250,000 ratones or shoots had been set out during the last year, and that more would be planted this year. There are large areas in the northern part of the province well adapted to the cultivation of this plant which are still uncleared and could be bought cheap.

From the best general information which I can at present gain, I would estimate the exportation of tobacco last year at 13,000 quintals and that of maguey at 9,000 picos.

It has been proven that there are good coffee, cacao, and indigo lands in the province, and their cultivation should be encouraged.

4. Tobacco slightly less than Cagayan and Isabela prices.

Most of the maguey is taken to Ilocos Sur, as a better price by 20 per cent can be obtained there than here, on account of its being an older market.

Little attention has been given to coffee, cacao, and indigo since the revolution, and scarcely no crop is being gathered.

Very respectfully,

PAUL F. GREEN,
Provincial Supervisor.

Prof. F. LAMSON-SCRIBNER,
Chief of Bureau of Agriculture, Manila.

PROVINCE OF ILOCOS SUR,
Vigan, September 8, 1903.

SIR: In reply to your letter of August 28, I have the honor to state the following:

1. There are in this province private lands that can be obtained by purchase at a rate varying from \$50 to \$200 United States currency per hectare. On account of the small quantity of land and the large number of people, the price of land is very high, but at the prices named there can be purchased a considerable quantity.

2. The wages usually paid farm hands range from 20 to 40 cents Mexican per day.

3. The principal money crops in this province are maguey and sugar. They could be advantageously increased by irrigation and the use of modern methods of farming.

4. It would be impossible to give even a poor estimate of the amount of income derived from these crops. They are raised in small lots and by many people, then bought up by the larger dealers, and thus no possible estimate could be obtained.

5. There are many obstacles to overcome to secure better crops. The principal one is the inherent laziness of the people. As a rule they care little for money, and so long as they get along they are satisfied. Then the methods of work which they have need to be changed, new tools introduced, and a general overcoming of the primitive ways which they have been taught and still cling to. The land here is very rich and it seems to me that if some one who knew how would go to work and help the people to new methods that a fine showing could be made here.

Very respectfully,

Prof. F. LAMSON-SCRIBNER,
Chief of Bureau of Agriculture, Manila.

J. C. HAWLEY,
Provincial Supervisor.

PROVINCE OF OCCIDENTAL NEGROS,
Bacolod, September, 1903.

SIR: In answer to your circular letter of August 28, 1903, I wish to state that:

1. There are many haciendas in Occidental Negros for sale and at prices less than their assessed value. In the northern part of the province I have been reliably informed that land can be bought for from \$5 Mexican per hectare up. This land is rolling and about 4 or 5 miles from the sea, has been cleared but worked very little, and is very fertile and well suited to the cultivation of hemp, cacao, tobacco, and cane. Sugar lands can be bought from \$30 hectare up, according to how hard pressed the owner may be.

2. Men planting palay get 1 real (12½ cents) per day and food. Men working in cane fields get more, sometimes getting as high as \$1.50 per week with food. It should be remembered that a great deal of the farm work here is done by "paquiao" or small contracts—such as planting or transplanting cane, rice, etc.—where the laborers get so much per 1,000 shoots set out.

3. Indigo was formerly the big crop in Negros, in the sixties and seventies, but died down before the increase in sugar production; now several hacenderos are planting again. Sugar was and is the principal crop here, and cultivated properly will yield good results, though the lack of roads makes the best and freshest lands almost inaccessible. I was informed by Mr. Stevens, a planter from Hawaii, who visited this province last year, that the hacenderos here lost on their sugar in the following manner: First, they raise a poor grade of cane; second, they only get 45 per cent of the juice; third, the sugar made is of a poor grade, and fourth, transportation from fields to mill is costly and equally so from mill to coast. Hemp is a good paying crop and is being sown in larger quantities than before. It has the advantage of being very healthy and resistant to grasshoppers; also does not need much care; is generally raised on shares. The demand seems to exceed the supply, as at present a picul of abacá is worth about \$27 Mexican. Rice: The best rice lands produce 80 or 90 cavans of palay to the hectare, and it is a very safe crop if locusts don't eat it up. At present prices of rice no crop would pay better. Other crops that bring in money are tobacco, cacao, bonga, and cocoanuts, though none of these are cultivated on a large scale. Tobacco is the money crop of Escalante.

4. Any estimate made would be very wide of the mark, but I think the limit would be not over 1,000,000 piculs of sugar per annum; 100,000 cavans of rice; 2,500 piculs abacá; 2,500 piculs tobacco (this is a pure guess), and 2,000 piculs copra.

5. The great evil here is the lack of money and the system of doing business on credit by means of which the hacenderos always keep in debt and pay such rates of interest that they will never get out. For instance, they borrow money at 12 per cent (sometimes 30 per cent), bind themselves to buy all their supplies from the house in Iloilo which advances the money, also promise to freight their crops in the company's boats, store in the company's warehouses, and sell through the company, so that by the time the account is closed they find that they have paid about 50 per cent on their loan or more—generally more. With the hacenderos always in debt, I don't look forward to any great improvements in agriculture until people with money come to take a hand in developing the country. My own idea is that agricultural companies and agricultural banks, such as exist in Java and Sumatra, would do a great deal toward opening up the country.

It stands to reason that a man heavily in debt and with bankruptcy staring him in the face does not feel like improving his farm when he may be sold out to-morrow.

Very respectfully,

J. D. FAUNTLEROY,
Provincial Supervisor.

Prof. F. LAMSON-SCRIBNER,
Chief of Bureau of Agriculture, Manila.

PROVINCE OF OCCIDENTAL NEGROS,
Bacolod, September, 1903.

SIR: Replying to your interrogatory to this office of July 10, 1903, I have the honor to advise you as follows:

1. There is always salable land in western Negros, the price of which varies from 25 to 150 pesos per hectare. At present agriculture is in such a state of decadence, owing to lack of capital, death among cattle, cholera, paludism, drought, locusts, rats, frogs, etc., that two-thirds of the private lands are lying uncultivated, and there is now more land for sale than ever before. I may say, practically, that proprietors are willing to sell their land at the assessed valuation.

2. Laborers receive at the present time 1 peso per week and meals. As regards meals, the frugality of our laborers is proverbial; they are content with a little rice and vegetables or fish, which food they prefer to meat. The cost of meals averages 18 centimos per day per laborer. On the haciendas, besides the field laborers, there are others, employed in the sheds during the grinding season, who receive 1½ pesos per week and meals. The provincial government is to-day paying road laborers 40 centimos daily, without meals.

3. The crops in the province are sugar, rice, corn, tobacco, abacá, bananas, buyo, bonga, coffee, cacao, copra, tuba, other fruits, bamboo, nutritious tubers, etc., the most important being sugar (our characteristic crop), tobacco, abacá, and copra, which are exported; the balance are for interior consumption, although at times portions of the same are carried to neighboring islands. It is evident that the agriculture of this province may be greatly increased. With capital, machinery, and improved methods there is not a doubt that agriculture in western Negros, with its soils of exuberant fertility, watered by numerous rivers (constituting a veritable treasure of motive power and which are inexhaustible fountains for irrigation), would take an extensive upward sweep, hitherto undreamed of; for it would be but natural that man's efforts should prove very much more efficacious in this paradise of fertility, where reigns eternal spring, than in other countries, in which the planter can only succeed in wresting from the soil the fruit of his sweat by the aid of art and science.

It is difficult to calculate the total amount yielded by agriculture in the province at present. In normal times the crop of sugar (with our defective methods of elaboration—to say nothing of defective cultivation—in which, according to those well versed on the subject, 45 per cent of saccharin is lost), is about 1,000,000 piculs annually for the entire province. That of rice is estimated at 500,000 cavans; of corn at 25,000 cavans; of tobacco at 8,000 quintals; and of abacá at 1,500 to 2,000 piculs. In the past year the corn crop was larger and further good increases are also expected in the future in tobacco and abacá, especially the latter, of which planters having resources at their command (taking into account the fact that this plant has suffered very little—in fact, almost nothing—from the consequences of public calamities from which this province and all of the Philippine Islands are suffering, and in view of the good prices paid for abacá, due undoubtedly to its free entry into the United States), have made sowings in such of their land as is suitable to this cultivation.

5. The obstacles at present standing in the way of agricultural progress may be summed up in the scarcity of capital brought about (as is inevitably the case) by a system of tyranny, almost exorbitant, with regard to the calamities and misfortunes from which the planters suffer. Loaning funds at 25 per cent annually is considered a favor, as the usual charge is 40 per cent, and even more in some cases. Banking and commercial houses, in this locality and in Iloilo, loan money on mortgage upon real property ostensibly at 15 per cent, but practically the interest amounts to 40 per cent on account of the conditions imposed by the contract, which are exceedingly onerous to the debtors; such, for instance, as selling the sugar to the creditor or through him; transporting the products via the ships of the creditor; procuring machinery, materials, and other necessities from the creditor, etc. The depreciation of Mexican money and the reduction in the price of sugar, together with the calamities mentioned at the beginning, may give some idea of the condition to which agri-

culture and planters in this province have been brought—a condition only remediable by the establishment of agricultural banks which will loan money at reasonable rates of interest. This is the radical remedy for the parent cause of all our present ills. From this spring naturally the problems of means of transportation, scarcity of cattle occasioned by the death of 90 per cent of our stock, perfecting of machinery, and improvement of methods. Then, there is indisputable need of a railway in this province with a branch passing through the towns of eastern Negros, on the other side of the mountain range; such improvement established, great gains would accrue to the enterprise, considering the present high cost of land transportation, which averages from 10 to 25 centimos per picul over a distance of 8 kilometers. As regards methods and implements of cultivation, these may also be much improved by a study of the land, by planting in each field the products most suitable to its particular soil, and by the employment of cutting implements for palay, of portable machines for turning and plowing the ground which would offset the present scarcity of working cattle, and of laborers during harvest time (which season coincides exactly with that for plowing and planting sugar cane). Now, as regards portable machines, it should be borne in mind that property in this province is very much cut up, and that a portable machine would not have the beneficial results that would accrue if employed for but a single hacienda. However, with good means of communication between haciendas, there is no doubt that the employment of such machines would meet with the highest success, and that the planters would unite in using them. As to the elaboration of agricultural products, we can only speak of sugar, this being at present the most extensively grown crop in this region. As I have already stated, the elaboration of sugar in this province suffers a loss of some 45 per cent of saccharin, according to the opinion of experts, while it is said that in Hawaii the loss of such matter is reduced to some 5 per cent, due to the greater degree of perfection of the machinery and boiling apparatus in use there. Our agriculture and our industries may be said to be still in their infancy, and it is only natural to suppose that they would be susceptible to great progress, considering the inexhaustible resources of our soil.

Very respectfully,

L. LOCSIN RAMA,
Provincial Governor.

Prof. F. LAMSON-SCRIBNER,
Chief of Bureau of Agriculture, Manila.

PROVINCE OF ORIENTAL NEGROS,
Dumaguete, September 14, 1903.

SIR: I have the honor to acknowledge receipt of your kind letter dated July 10 of the present year, which for reasons not of my willing I have been unable to answer in proper time, for which I request that you excuse me.

In accordance with the questions of your letter I beg to inform you of the following:

1. On account of the precarious condition of the agriculture in this province, private lands could easily be gotten under the following average prices: Superior class land, from \$60 to \$100 Mexican per hectare; inferior class land, from \$20 to \$50 per hectare. These are the prices that prevail generally in the majority of the towns of the province, excepting only the lands of the town of Bais, devoted to the cultivation of the sugar cane, which on account of their special kind are appraised in the average at \$200 per hectare.

2. The average wages for an ordinary farm laborer is 12 cents Mexican a day, with two meals, that generally consist of cooked rice with a little salted fish or dried fish, with fresh vegetables sometimes.

3. The hemp, from \$16 to \$20 Mexican per picul of 137½ pounds, according to the quality. Sugar, from \$4 to \$5 per picul, according to class. Corn, \$5 a cavan. I do not have the least doubt that these crops can advantageously be increased.

4. Average income derived from main crops: Hemp, 50 per cent; copra, 25 per cent; sugar, 5 per cent; corn, 40 per cent.

5. Three are the main obstacles to overcome in order to secure greater agricultural activities in this province. First, the lack of capital to protect the farmer, and that only a reasonable interest be imposed; second, the original implements that are heretofore being employed for the field labor, as also the old machinery for the grinding of the crops; third, the natural indolence of our farm laborers.

Very respectfully,

D. McLAREN,
Provincial Governor.

Prof. F. LAMSON-SCRIBNER,
Chief of Bureau of Agriculture, Manila.

PROVINCE OF SORSOGON,
Sorsogon, September 22, 1903.

SIR: I have the honor to make the following report on agricultural conditions in this province, in reply to your communication of August 28:

1. Fully one-half of the land of the province may be considered as being on the market. The prevailing prices are, for first-class hemp land, from \$50 to \$60 Philippine currency per hectare. Second-class hemp land, from \$20 to \$30 per hectare. Rice and uncultivated lands, from \$5 to \$30 per hectare.

2. It is customary to allow the laborers in the field one-half of the crop they market. In exceptional cases where laborers receive day wages the average wage is \$1 Philippine currency per day.

3. The principal crop at present is hemp. In order to increase the crop additional labor is required.

4. It is estimated that two-thirds of the land in the province is planted in hemp. First-class hemp yields an average of 6 piculs per hectare, annually, which sells on the local market at \$20 Philippine currency per picul. Allowing one-half to the laborer, the owner nets \$60 Philippine currency. Second-class hemp land nets about 20 per cent less.

5. The first obstacle to overcome is additional laborers and draft animals. Then good roads are required to open up a market.

Very respectfully,

E. WESTERHOUSE,
Provincial Supervisor.

Prof. F. LAMSON-SCRIBNER,
Chief of Bureau of Agriculture, Manila.

PROVINCE OF TARLAC,
Tarlac, September 11, 1903.

SIR: Referring to your favor of the 28th ultimo, concerning land, wages, and agricultural products, I have the honor to reply to your questions, but I have such little information myself that my answers are very unsatisfactory:

1. There are private lands in this province, and the only sale that I know of was for about \$100 United States currency per kiñon. There seems to be no recognized price for land, and the price, so far as I can ascertain, depends on how necessary it is for one man to sell and how much the other wants the land.

2. Ordinary farm laborers, I am told, receive from 20 cents to 40 cents Mexican per day. I have to pay 50 cents per day for common laborers on road work.

3. The principal crop of this province is rice and the second in importance is sugar. They could both be greatly increased.

4. I can get no reliable information as to the amount of income from these crops. Upon inquiry I got such different answers that I concluded they were wild guesses.

5. More work animals and better methods of farming are necessary to larger crops and greater agricultural activities. It is my opinion that no more than one-twentieth of the land in this province suitable for successful agriculture is being cultivated.

Respectfully,

S. C. PHIPPS,
Provincial Supervisor.

Prof. F. LAMSON-SCRIBNER,
Chief of Bureau of Agriculture, Manila.

PROVINCE OF ZAMBALES,
Iba, September 18, 1903.

SIR: Replying to your favor of the 29th of August, 1903, I beg to state:

1. That there are in this province private lands which may be bought at the price of \$80 per hectare.

2. That the wages ordinarily paid to laborers amount to 1 peso per day.

3. The principal crop of this province at present is rice; sugar cane is also cultivated, but upon a small scale, and the yield is only used for local consumption. I believe that these crops could be improved.

4. The present crop of rice may be estimated at approximately 270,000 cavans and that of sugar cane at 10,000 piculs.

5. To secure a better harvest of the products mentioned in No. 3, it is necessary, in my opinion, to overcome two chief obstacles, which are lack of carabaos and frequent drought. In order to overcome these obstacles, planters should be supplied

with capital to enable them to buy carabaos and construct irrigation canals. Such capital could be furnished them if an agricultural bank were established in this province.

There are 27,375 hectares of land under cultivation and there are 31,870 hectares of public lands which could be cultivated.

Respectfully,

POTENCIANA SESACA,
Governor.

Prof. F. LAMSON-SCRIBNER,
Chief of Bureau of Agriculture, Manila.

EXHIBIT C.

REPORT OF WM. S. LYON, IN CHARGE OF DIVISION OF PLANT INDUSTRY.

MANILA, August 31, 1903.

SIR: In compliance with your letter of instructions of July 18, I have the honor to submit the following report, giving a review of the operations of the division of seed and plant industry for the year ending August 31, 1903:

SEED DISTRIBUTION.

The seed distributions of the bureau are made semiannually, in recognition of the two well-defined planting seasons. The distribution which has lately come to a conclusion was designed to meet the requirements of plants capable of maturing their crops under the influence of prolonged rainfall and a minimum of sunshine. Corn, most grasses and forage plants, and such vegetables as quickly effect their full development—like lettuce, radish, and summer squash—are fair examples of this class. Cotton, sesamum, tobacco, most pulses (beans, peas, etc.), and tomatoes are what may be called dry-season products, for they require less moisture, a maximum of sunshine, and cooler, drier weather, which prevail during December and January.

Owing to the great diversity of climatic conditions due to the varying elevations with small areas, no definite rules are possible defining the products of the two seasons, and our present knowledge, imperfect though it be, points to a more general limitation of the lines that now define the seasons for the planting of many seeds.

Some of the most gratifying features of the present seed distribution are the wide area of country covered by its operations, the consequent presumption of a widely spreading knowledge of the purposes of the bureau, and the opportunity it has afforded in bringing the bureau in touch with the remotest parts of the archipelago. The following is a complete list of the provinces to which seeds have been sent in the last distribution:

Abra.	Capiz.	Leyte.	Pangasinan.
Albay.	Cavite.	Marinduque.	Paragua.
Antique.	Cebu.	Masbate.	Rizal.
Bataan.	Ilocos Norte.	Mindoro.	Romblon.
Batangas.	Ilocos Sur.	Misamis.	Samar.
Benguet.	Iloilo.	Negros Occidental.	Sorsogon.
Bohol.	Isabela.	Negros Oriental.	Surigao.
Bulacan.	Jolo.	Nueva Ecija.	Tarlac.
Cagayan.	Laguna.	Nueva Vizcaya.	Tayabas.
Ambos-Camarines.	Lepanto-Bontoc.	Pampanga.	

Exclusive of the large distribution of seed rice, 21,205 packets of seeds have been sent to 772 individuals, making an average of 27 packets to each. These "allotments," as we call them, were issued upon written or verbal requests, free of all charge, the only stipulation made being that the recipient report to the bureau the result of the plantings. To facilitate this each allotment was accompanied by a blank form, with headlines clearly indicating the information desired. It was thought that this information, procured from so many sources, would be instrumental in fixing the value of a number of plants not yet widely grown in the islands.

From our previous distribution returns were received from only 5.2 per cent of the people supplied, and although it is still too early to look for many complete reports from the last distribution, it seems desirable that other methods be adopted to secure the results desired.

A card system of records is kept, giving name and address of each applicant and the varieties and quantities of seed issued, thus enabling the bureau to communi-

cate at any time with the recipients and obtain specific information concerning any variety of seeds distributed.

All seeds are stored closely in metal canisters, or metal-lined boxes, to protect them as much as possible from the depredations of insects, as well as from deterioration due to the climate; and, before being sent out for distribution, are put into paper bags, closely wrapped in paraffin paper, then in a covering of tarred, felted paper, and the whole tightly tied up in stout manila paper. Such a package could be immersed in water for a considerable time without injury to its contents.

The general distribution of seeds has been made up of the following varieties:

Asparagus	1	Lima beans	3
Beets	5	Lucern	1
Bush beans	9	Lupine	1
Cabbage	7	Melon (musk)	6
Carrots	3	Rhubarb	1
Cauliflower	1	Salsify	1
Celery	3	Onions	10
Clover	1	Parsnip	1
Corn (sweet)	6	Peas	9
Cotton	6	Pepper	3
Cowpeas	1	Pole beans	5
Melon (water)	5	Pumpkin	3
Okra	3	Radish	5
Cucumber	5	Squash	6
Eggplant	2	Sulla	1
Endive	2	Teosinte	1
Field corn	2	Tobacco	1
Leek	2	Tomato	5
Lentils	1	Turnip	2
Lettuce	6	Velvet beans	1

From this it will be seen that in addition to field and forage plant seeds, a generous and varied assortment of vegetable seeds has been sent out for the purpose of stimulating interest in procuring, both for home and market purposes, an increased and better supply of fresh-food products than the native gardens generally afford.

Practically all the applications for seeds have come from native farmers. School-teachers, provincial officers, commandants of military or constabulary posts, and merchants or traders having small lots in town and without other interest than procuring fresh vegetables, have made up a considerable portion of the people supplied. Thus far it does not appear that we can look for any specific benefit or stimulus through these channels to the agriculture of these islands; nor does there seem to be any valid reason why this element should be supplied with free garden seeds any more than with free commissaries. On these grounds, therefore, it is strongly urged that the free distribution of seeds be suspended except in case of those who, in the opinion of the bureau, are bona fide farmers.

Our distributions of field seeds have been more encouraging, and specific inquiries for various cereal, forage, textile-fiber or oil-yielding seeds have shown an appreciable increase. This would seem to point to a gradual dissemination of new or better varieties of economic plants than those now in common use.

Nor do the same influences operate that disincline the native farmer to expend labor upon such luxuries as vegetables, which, outside the neighborhood of a few large towns, represent no direct money value to him. He is generally conscious of diminished yields, poorer quality, and less money reward than formerly. He does not know if this situation is to be ascribed to degenerate seeds, to defective cultivation, or to soil exhaustion, but his mind is in a receptive state, disposing him to display interest in, and expend downright hard labor upon, crops that he has grown heretofore, and the measure of whose requirements he thinks he has carefully taken. Advantage has been taken of this to make large distributions of rice, tobacco, and corn of the most approved varieties known. These will be followed on the opening of the next planting season by special issues of cotton and sugar cane.

The difficulties in the way of a wise and effective distribution are many and discouraging. The small proprietor or tenant farmer, the actual tiller of the soil, the poor and generally ignorant owner of one work animal and perhaps a cavan of land, the one who knows of nothing better in the way of seed than such as he finds at hand, and which his forefathers sowed before him, is the one we aim to reach. Every dictate of humanity and expediency points to the advantages that must in time inure to the agriculture of these islands by elevating and building up this class, and yet this is the very class which we have found it most difficult to reach. The principal bene-

ficiaries of these seed distributions have been a small class of landed proprietors, who are sufficiently well educated to appreciate the value of the best varieties of seed, and, as a rule, also well able to pay for them. These, to a great extent, are landlord farmers, and, as their interests and those of their tenants are identical, it is, of course, desirable to assist them in every way to procure the best seeds, and, for the present at least, we can only hope to reach the poorer classes through them.

SEED AND PLANT INTRODUCTION.

Seed and plant introduction has gone on apace during the past year, and many varieties of field, garden, and orchard products have now for the first time been brought into the archipelago. In addition, a few native and naturalized plants of exceptional merit or promise have been brought under observation. Collections have been made and planted of lumbang (*Aleurites triloba*), casuy (*Anacardium occidentale*), yams (*Dioscorea* species), ilang-ilang, (*Cananga odorata*), and endemic varieties of oranges, lemons, and mangoes. This work was undertaken with the specific purpose of determining the cost in labor of subjecting them to systematic cultivation and what practical advantages, if any, might follow such treatment. The oil, root, essence, and fruit-producing plants are all spontaneous here, and their products are articles of prime commercial utility. They are all exceedingly popular with the native farmer, although it must be conceded that their popularity is in a measure due to that very spontaneity which gives some assurance of a crop without the expenditure of much labor. Nevertheless, if we succeed in fully demonstrating that a money recompense will be the result of such additional labor, the native farmer will ultimately come to expend it willingly.

With but few exceptions the distribution of the exotic economic plants so far introduced has been confined to the experiment stations now in operation by the bureau. Nor is their general distribution to be commended until ample trials of their worth and adaptability have been made. Irrespective of this, their propagation will be carried on, so that liberal distribution may follow rapidly when their utility has been determined. Unfortunately, the experiment station appeals only to the few to whom it is readily accessible. Yet, under present conditions, we must look to it as the most useful factor in seed and plant distribution.

There is still a strong and natural lack of confidence in American methods which will only be outgrown when continued demonstration has proven their superiority. As an illustration of this, a single instance may be cited where the writer invited a considerable number of farmers, professedly deeply interested in the restoration of the coffee industry in Batangas, to witness one of the preliminary steps connected with its proper culture. This, though nothing more occult than laying off the land in squares, and a portion in order of fives or quincunx, was a process unknown to the native farmer, and no illustrations of either method can be found elsewhere in the province. Due publicity was given to the event, yet but one planter chose to avail himself of the opportunity to learn the correct way of laying out a tree plantation. Nevertheless, it may not be taking too optimistic a view to hope that, within a year or two, when these people observe the great economy of labor afforded by cultivating two ways, they will be anxious and willing to acquire those details which, from lack of confidence, now fail to appeal to them as useful.

American field corn.—Promising results have been secured in Batangas Province from corn of the second generation of seed, originally imported and distributed by the bureau. Reports received by the bureau have, in the main, been disappointing, showing a tendency in the plant to dwarf and ear out close to the ground. This was the case with our experiments made during the dry season. In Batangas, on good but shallow land, may be seen stalks of good size, bearing two and three large, well-formed, well-filled ears that will yield one-third more of shelled grain per unit of land than a similar adjoining area in native seed. The success of the crop is the more noticeable, as this strong-growing, white, Virginia dent corn was, in conformity with native custom, planted in rows only 16 inches apart and afforded no cultivation whatsoever. That it would have produced a still larger yield with wider planting and a reasonable amount of tillage is hardly a matter for doubt.

The use of corn is extending into provinces where formerly it was not cultivated. Yet, where it is largely grown, it generally commands a price which prohibits its use for stock feeding or fattening purposes. Its availability for this purpose will never occur until, with improved seeds and better cultural attention, its yield shall have been increased one-half or more. At the present time a very large amount of ill-directed, ill-performed, and unnecessary preparatory work is expended on securing what a professional corn grower would call a one-third crop. This is emphatically a remediable condition. The use of acclimatized American seed corn will undoubtedly increase the yield one-fourth or more; and, by expending more labor in

subsequent tillage operations and less in preliminary work, the crop may conservatively be expected to be increased by another fourth, thus adding quite 50 per cent to the present output, without increase of either acreage or farm labor.

Teosinte (Reana luxurians).—A cheap and abundant supply of good forage is a factor in the prosperity of every agricultural country, and particularly so in the Philippines, where, as yet, there are practically few facilities for inland transportation other than those afforded by animal power, and where, in consequence, the maintenance of the beast of burden in prime condition is at all times a matter for serious consideration. The native grasses in common use are largely deficient in yield or nutriment, or both, and, with a view to the betterment of this situation, the bureau has introduced a considerable number of forage plants and grasses. Of these, the kind named above gives especial promise of value and utility.

Teosinte, although originally introduced into these islands by the Spaniards, seems never to have become widely dispersed and, at the time of its reintroduction by this bureau, was lost to cultivation. Wherever tried, such good results have followed that it is quite safe to predict its general adaptability to the physical conditions of the country. From the cultivator's standpoint it is an annual or perennial grass, according to the manner in which it is managed. If allowed to fully perfect its growth and mature seed, the plant dies, but if cut before the flowering season, it quickly grows up again and in a few weeks affords another crop. How many times these new crops may be harvested profitably we do not yet know, although a number of successive crops have been secured on the trial grounds of the bureau. From seed sown on May 2 in Batangas Province, one crop was taken on June 26, and on August 1 it was ready for a second harvest.

Disease-resistant coffee.—Particular interest attaches to an importation of new coffee seed into the islands, and the final outcome of the experimental plantings at Lipa, in Batangas Province, under the bureau's direct control, will probably have a strong bearing on the future of this great industry in the Philippines. The circumstances leading up to the inception of this planting enterprise were the outgrowth of petitions addressed to this bureau requesting that efforts be made to reestablish this once dominant industry, and, in conformity with the wishes of our correspondents, a careful inspection was made of the once largely planted central Batangas plateau, and, as offering conditions typical for a large area, a selection of trial grounds for coffee was made in the town of Lipa.

Through the public spirit and enterprise of Señor Sixto Roxas, of Lipa, a tract of about 10 acres was placed by him at the disposal of the bureau for a term of years, the tenure of which was to extend over the necessary duration of the experiment. The same gentleman has provided the unskilled labor to carry on necessary field operations, while the bureau's contribution to the same end covers seeds, tools, and general supervision and direction of the work.

It is unnecessary here to give more than a superficial sketch of the conditions which existed in south central Luzon prior to 1891. Until that time extensive coffee plantations, covering thousands of hectares of land, abounded everywhere in the central part of Batangas Province; and that the production of coffee was enormously profitable is testified to not only by living planters, but by the mute evidences of decadent wealth still visible in the then coffee-growing centers. From that time its history has been only a repetition of that of all coffee-growing countries in the Orient invaded by the leaf-spot fungus and root borer. In less than three years from the invasion of the disease the plantations were practically wiped out of existence. The variety grown was exclusively the Arabian berry, and natural conditions were exceptionally suitable for the best development of the plant as well as of fruit of peculiar excellence.

It is to-day quite out of the question to secure from any locality in Batangas Province enough fruit to ascertain what its maximum of excellence would be, if submitted to the manipulations practiced on a modern Javanese coffee estate. Its past history gives assurance of a product so superior that it would be beyond competition with the coffees of Brazil which now flood the markets of the world. This excellence was in a large measure due to the natural conditions, which would prove equally beneficial in improving the quality of some of the more robust growing kinds.

To this end an importation of seed was made, and a large number of plants reared, of the Liberian and Maragotype hybrid, and these have been successfully transplanted and are now growing on the land selected in Lipa for this purpose. The entire plantation was plowed, cross plowed, and harrowed. As it showed by test some soil acidity, one-half was top-dressed with lime at the rate of 1,000 kilos per hectare, the land lined out in two directions, and holes dug having a width and depth of 60 centimeters, the soil left exposed to atmospheric influences for two weeks, and the trees planted—the Maragotype at 4 meters and the Liberian at 4½ meters

equidistant. The soil of the plantation is generally shallow, but of excellent quality, while the subsoil—a soft, crumbling rock—is freely permeable to both water and plant roots. An intercalary crop of corn is now maturing on the land, and is to be followed by a rotation of sesamum or cotton. Plantings for shade have been dispensed with, the elevation (300 meters) and the vigor of the varieties selected being deemed sufficient to justify this departure from usual practices, here as elsewhere.

Very great dependence is placed upon the virtues of frequent and thorough cultivation, and, to effect this with the most lasting benefit, wide planting and the introduction of hoed crops for the first three years will be resorted to. While it is designed that this shall be the general treatment accorded to the whole plantation, portions have been marked off that will be subjected to more intense cultivation, to prophylactic sprayings, and to the systematic application of manures, pruning, etc. Records of outlay covering both methods are being kept by which it is expected that a balance sheet may be struck that will determine the practical, commercial value attaching to each method.

The presence of a number of scattered trees in the old plantations, unaffected in stem or root, indicates that the coffee borer has followed the course of many insect scourges, and, if it has not disappeared, it has at least abated for want of abundant material on which to thrive. A close watch will be kept and, should it reappear, systematic efforts made to stamp it out. *La Mancha* (*Hemileia*) is still in ample evidence, but it is hoped that one or both of the reputedly resistant varieties mentioned above may withstand its attacks. That there is any resistance that amounts to immunity is very doubtful; but it has been fully demonstrated that maintenance of the plant at all times in a good growing condition is most strongly conducive to immunity.

The coffee trees of Batangas succumbed to disease under a treatment of nearly absolute neglect. The present experiment contemplates continuous high-pressure tillage. General reliance, nevertheless, will be placed upon the alleged power of resistance of the varieties under observation, supplemented by such cultural treatment as will at all times guarantee the vigor and health of tissue so unfavorable to the propagation of parasitic diseases.

Respectfully,

Prof. F. LAMSON-Scribner,
Chief, Bureau of Agriculture, Manila.

WM. S. LYON,
In Charge of Division of Plant Industry.

EXHIBIT D.

REPORT OF THE BOTANIST.

MANILA, August 31, 1903.

SIR: I have the honor to submit herewith my report as botanist in this bureau during the past fiscal year.

The botanical work during the past year has been successfully prosecuted, notwithstanding the lack of authentically named specimens and essential publications, and much has been accomplished, especially in the matter of building up a reference library and herbarium and compiling data for future publications.

The work has followed the general lines inaugurated on arrival here in April, 1902. During the past year, in addition to my duties as botanist for this bureau, I have also acted in the same capacity for the forestry bureau, having been appointed botanist in that bureau by act of the Civil Commission, July 20, 1902. My appointment in that bureau has entailed a vast amount of extra work, especially in the matter of identifying forest trees of the Archipelago, and necessitated much labor on my part, outside of official hours. By act No. 807 of the Civil Commission, my connection with both the bureau of agriculture and the forestry bureau was severed by the transfer of the botanist to the bureau of government laboratories, it being intended to organize a botanical laboratory, on the same basis as the others in that bureau, to be under the general direction of the superintendent.

HERBARIUM.

During the past year attention has largely been given to the building up of the herbarium, and in this line much has been accomplished, considering the adverse conditions incident to organizing this work in the Tropics. The herbarium now contains 5,124 mounted specimens—all, practically, the work of the past year. In April,

1902, when the work was commenced, there was no accessible herbarium in Manila. The specimens secured by the employees of the forestry bureau previous to that date were, for the most part, still in their original packages. This material was turned over to the botanist in August, 1902, and much time has been consumed in arranging this material, completing the labels, distributing the duplicates, etc. After destroying the worthless material, and that which had been rendered of no value by the ravages of insects and moisture, there were left 852 numbers, and this material was taken to Buitenzorg, Java, in September, 1902, where all of the material that was in condition for accurate identification was named. These specimens form the basis of our herbarium, and was the first material to be mounted, and distributed into families and genera.

Of the 5,124 mounted specimens now in the herbarium, 4,281 are Philippine, the remaining 843 having been collected in or received in exchange from foreign countries. Of the Philippine material, 2,725 specimens have been included in the numbered series distributed from the bureau of agriculture. Of these, 1,581 were collected by employees of the bureau of agriculture and 1,121 by the employees of the forestry bureau. Of the remaining 1,556 Philippine specimens, 852 were collected by various employees of the forestry bureau previous to my arrival in the archipelago, 242 specimens were presented by Mr. D. Le Roy Topping, 11 by Dr. A. Loher, while 189 were found in the forestry bureau, having been collected in 1894-95 by Rufinio Marave. The remaining 262 specimens represent miscellaneous unnumbered collections by various employees of the bureaus of agriculture and forestry.

The foreign material in the herbarium comprises 555 specimens from the director of the 's Lands Plantentuin, Buitenzorg, Java, for the most part having been collected in the botanical garden, under my direction, in October and November, 1902; 149 specimens from Dr. H. N. Ridley, director of the botanical garden at Singapore; 119 specimens of Indian grasses from the United States Department of Agriculture, while 20 specimens were collected by me at Labuan, British North Borneo, on my return from Java in November, 1902.

All of these specimens have been poisoned, mounted, identified as far as possible at the present time, and distributed into their proper families and genera during the past year. For convenience in reference the herbarium has been arranged in strictly alphabetical order under families and genera.

HERBARIUM CASES.

After a careful consideration of the relative merits and demerits of metal and wooden herbarium cases, the latter have been adopted. Cases made of native lumber have been found unsatisfactory, probably because of the use of unseasoned lumber and poor workmanship. California redwood seems to be well adapted to this purpose, and it is, moreover, practically proof against the ravages of white ants and other insects. The style of case adopted is an absolutely plain one, with double, glass-paneled doors, and each contains 18 pigeonholes of standard size, arranged in three tiers of 6 pigeonholes each.

PRESERVING AND MOUNTING SPECIMENS.

Material destined for the herbarium, before mounting, is poisoned by immersing for a short time in a nearly saturated alcoholic solution of corrosive sublimate. When mounted, each sheet is stamped with the date of poisoning. Specimens are mounted on herbarium sheets of standard size by gluing with a mixture of gum arabic and gum tragacanth, and made further secure by the use of gummed strips of paper over the coarser portions of the specimen. It is believed that specimens so treated will be entirely exempt from the ravages of insects. Little trouble has been experienced in securing suitable paper in Manila for herbarium sheets, genus covers, etc.

DUPLICATES.

The only duplicates prepared for distribution have been those of the numbered series, and no distinction has been made between forestry bureau and bureau of agriculture material, in order to avoid the confusion incident to more than one numbered series. Plants in the numbered series generally represent from 3 to 12 specimens, and this material has been arranged in sets for distribution to various botanical institutions and for purposes of exchange. With lack of facilities for properly handling the specimens, considerable damage has been wrought by insects, and in the future it will be necessary to poison all material, as it is received from the field, with corrosive sublimate, in order to preserve it properly.

Sets of duplicates have been distributed to the following institutions:

The United States National Herbarium, Washington, D. C.	3, 707
The K. K. Botanische garten, Berlin	2, 302
The New York botanical garden, Bronx Park, New York	1, 346
The 's Lands Plantentuin, Buitenzorg, Java	600
The botanical garden, Singapore	496
The United States Department of Agriculture	110

Total 8, 561

Nine sets, containing about 5,500 duplicates, are as yet undistributed, and in the near future these will be sent to various institutions in Europe and America, preference to be given to those institutions that already contain Philippine material.

IDENTIFICATIONS.

Great difficulty has been experienced in properly identifying much of the material collected, on account of lack of reference books and authentically named botanical specimens for comparison. Nearly all the plants collected have been placed in their proper families and genera, but in large or critical genera it has been quite impossible to specifically identify many of the specimens. Three thousand one hundred and ninety-three identifications have been made in the office during the past year, aid having been received on but a portion of the 1,000 specimens taken to Buitenzorg, Java, in September, 1902. Dr. H. N. Ridley, of Singapore, very kindly identified the 20 specimens collected at Labuan, and Prof. W. J. Spillman, agrostologist in the United States Department of Agriculture, has favored me with the identifications of 52 species of gramineae secured in Java. With the exception of the aid acknowledged above, no assistance has been received from outside sources. In order to verify the identifications and to properly name the material which it is impossible to identify here, as complete sets of duplicates as were available have been sent to the United States National Herbarium at Washington and to Dr. A. Engler, director of the botanical garden at Berlin. Doctor Engler has offered us aid in identifying this material, as has also Sir William T. Thistleton-Dyer, director of the Royal Gardens at Kew, England. The herbaria of the latter two institutions are especially rich in Philippine collections, and it is especially important for us to have our specimens identified by comparison with those of previous collectors, now preserved at those institutions. When complete specimens have been available here, little difficulty has been experienced in identifying the species—at least to the genus—but much of the material being imperfect, it has been impossible to identify all with accuracy. Over 200 identifications have been made for the forestry bureau, of which only specimens without fruit or flower were available, but such specimens in all cases represented well known or especially characteristic species. At least as many more specimens in like condition have been submitted by the employees of that bureau for identification that it was impossible for me to name. Within the coming year it is probable that we shall receive identifications from outside sources of all the material represented in the duplicate collections that is in condition for accurate identifications, and when these identifications are received our reference herbarium can be considered as well established.

In working out identifications here, especial attention has been given to those families containing species of economic importance, and practically no attention has been given to the identification of species in such families as the Cyperaceae, Filices, Orchidaceae, etc.

WORK OF THE PHILIPPINE EXPOSITION BOARD.

In June, under your directions, I was instructed to take personal charge of exhibits in certain classes in groups 84, 95, and 107, for the Philippine exhibit for the St. Louis Purchase Exposition, to collect material and classify the same. After a consultation with Doctor Niederlein, in charge of the preparation of the exhibit, it was deemed advisable that I give my attention to classifying the material of vegetable origin already collected, and accordingly, during the month of June, I spent much time on this work, classifying 2,051 specimens of woods, fibers, fruits, oil seeds, medicinal plants, etc. A very large per cent of the material examined was found to be in such condition that accurate classification was impossible, and hence can only be entered in the catalogue of the exhibit under the local names, when these are given. The work of classifying this material was very difficult and discouraging, owing to the imperfect material upon which identifications had to be based.

CORRESPONDENCE.

Many letters of a botanical nature have been received and answered during the past year from various persons in the archipelago, in Europe, and in America. Requests have been received from Europe and America for herbarium specimens representing special families or groups, alcoholic material of certain species for histological and morphological work, seeds, and living plants, and as far as possible these requests have been complied with. Correspondence has been opened with various institutions and specialists in Europe and America regarding the identification of our botanical material, exchange of botanical specimens, publications, etc.

PUBLICATIONS.

With the great amount of time necessarily involved in the routine work of building up the herbarium, and in the partial identification of the many species already secured, comparatively little time has been available for preparing publications. Shortly after returning from Java in December, 1902, I presented a report to the forestry bureau on the results of the investigations in Java, including notes on the trip, a report on the method of investigating the forest flora of Java, a report on the botanical garden at Buitenzorg, and a report on the identifications of the species in the herbarium of the Philippine forestry bureau.

In this collection there were 852 specimens, representing 224 genera and about 400 species, 6 of which were described as new, and many others reported from the Philippines for the first time. This report, now at the bureau of public printing, is to be issued as the first bulletin of the numbered series from the forestry bureau.

In June, 1903, I presented for publication as Bulletin No. 4 of the bureau of agriculture a report on "Botany in the Philippines," consisting of a general review of the botanical work accomplished on the Philippine flora from the earliest times up to the present day. This report consists of a chronological consideration of the work of the Spanish botanists in the Philippines; the work of the European and American botanists on the Philippine flora; a sketch of the botanical garden in Manila; notes on the herbaria and botanical libraries that have existed in the past in Manila; the present distribution of Philippine botanical material in Europe and America; botanical work accomplished since the American occupation, and a bibliography of the works most essential for a thorough study of the Philippine flora. Much of the data for this report was secured from various publications available in Manila, personal observations, and conversation with various persons in the city; but a considerable per cent of the data was compiled at Buitenzorg, Java, in 1902, where I had access to the excellent library of the botanical garden at that place.

At the present time work is being pushed on the preparation of a card catalogue of the native plant names of the archipelago, with reference to their proper scientific identifications. The ultimate object of this work is the preparation of a dictionary of the native plant names, similar to those issued in Java, British India, Singapore, etc. This publication should be issued as soon as possible, as it will be especially valuable for the convenience of field parties of the forestry bureau. It is also proposed to prepare a publication on the families and genera of woody plants found in the Philippines, sample pages of which have already been submitted for approval.

A greatly needed publication, and a very important one, is the compilation of the names of all the species of plants with full synonymy known to grow in the Philippines, but no attempt has been made to prepare such a publication here on account of lack of books, and, moreover, it is understood that such a work is to be prepared by another institution, and accordingly it would be only a waste of time to attempt its preparation here.

In technical botanical work a paper entitled "New or Noteworthy Philippine Plants, I," has been completed and will shortly be submitted to some one of the American botanical magazines for publication. It is proposed to prepare from time to time, as material comes to hand, a series of papers under the above title, to include descriptions of new or little known Philippine species, notes on species of especial interest, or those that in the past have been imperfectly described, publishing such papers in some one of the several American botanical magazines, in order that the information may be available to all workers on the Philippine flora in Europe and America.

BOTANICAL PUBLICATIONS AVAILABLE.

The following botanical publications are now available in the office of the botanist, a portion of them the property of the forestry bureau, a portion the property of the bureau of agriculture, and others my own personal property:

Ahern, G. P. Compilation of notes on the most important timber tree species of the Philippine Islands. 1901.

- Ahern, G. P. Tree species of the Philippine Islands, arranged according to family. 1901.
- Bennet, J. Brown, R., and Horsfield, T. *Plantæ Javanicæ Rariores*. 1838-52.
- Bentham, G. *Flora Hongkongensis*. 1861.
- and Hooker, J. D. *Genera Plantarum*. 1862-83.
- Blanco, M. *Flora de Filipinas*. Ed. 1, 1837; ed. 2, 1845; ed. 3, 1877-83.
- Blume, C. L. *Museum Botanicum Lugduno-Batavum*, 1835-48.
- and Fischer, J. B. *Flora Javæ*. 1828.
- Bulletin de l'institute Botanique de Buitenzorg. (Complete except for the first number.)
- Ceron, S. *Catálogo de las plantas del herbario, Manila*, 1892.
- De Candolle, Alph. et Cas. *Prodromus systematis regni vegetabilis*. 1824-73. (Complete with Bucks's Index.)
- Aug. Pyr. et Alph. *Monographie Phanerogamarum*. 1878-96.
- Engler, A. *Das Pflanzenreich*. (Complete to date.)
- and Prantl, K. *Die natürlichen Pflanzenfamilien*. 1889. (Complete to date.)
- Fernandez-Villar, C. *Novissima Appendix ad Floram Philippinarum*. 1883.
- Gray, A. Botany of the United States Exploring Expedition . . . under the command of Charles Wilkes. *Phanerogamia*, 1 vol. text, 1 vol. plates. 1854.
- Hasskarl, J. K. *Plantæ Javanicæ Rariores*. 1848.
- Hooker, J. D. *Flora of British India*. 1872-1897. 7 vols.
- Icones Bogoricensis*, 1897. (Complete to date.)
- King, G. Materials for the flora of the Malayan Peninsula. Three volumes reprinted from the Journal of the Asiatic Society of Bengal. 1881 to date.
- Koorders, S. H. *Verslag eener botanische dienstreis door de Minahase* . . . N. O. Celebes. 1898.
- and Valetton, Th. *Bijdrage tot de kennis der boomsoorten van Java*. Seven volumes. 1894-1900.
- Kunth, C. S. *Enumeratio plantarum*. 1833-60.
- Kuntze, O. *Revisio generum plantarum*. 1891-98.
- Kurz, S. *Forest flora of British Burma*. 2 vols. 1877.
- Lourier, J. *Flora cochinchinensis*. 2 vols. 1793.
- Puigdallies, E. M. *Apuntes para el mejor conocimiento . . . de las principales especies arboreo-forestales de Filipinas*. 1895.
- Ridley, H. N. *The flora of Singapore*. 1900.
- Roemer, J. J., et Schultes, J. A. *Systema vegetabilium*. 1817-30.
- Rolfe, R. A. On the flora of the Philippine Islands and its probable derivation. 1884.
- Supplementary list of Philippine plants. 1885. (Manuscript copy.)
- Scribner, F. Lamson. Grasses in the Bernhardt herbarium described by J. S. Presl. 1889.
- Smith, J. *Enumeratio Filicum Philippinarum*. 1841. (Manuscript copy.)
- Tavera, T. H. Pardo de. *Plantas medicinales de Filipinas*. 1892.
- Trimen, H. *A handbook of the flora of Ceylon*. 5 vols. 1893-1900.
- Vidal y Soler, S. *Sinopsis de familias y géneros de plantas leñosas de Filipinas*. 1 vol. text, 1 vol. plates. 1883.
- *Phanerogamiæ Cumingianæ Philippinarum*. 1885.
- *Revisión de plantas vasculares Filipinas*. 1886.

Subscriptions have been placed for the following periodicals: The Botanical Gazette, Bulletin of the Torrey Botanical Club, the Journal of Botany, Annals of Botany, Curtis' Botanical Magazine, Hooker's *Icones Plantarum*, Journal of the Linnean Society Botany, Bulletin de l'Herbier Boissier, Botanische Zeitung, Botanisches Centralblatt, and Annales des Sciences Naturelles Botanique. Many other essential botanical works have been ordered, and are now in transit.

INVESTIGATIONS IN JAVA.

On August 30, 1902, under letter of authority issued by Capt. G. P. Ahern, chief of the forestry bureau, I left Manila for Buitenzorg, Java, in order to identify the accumulated botanical material in that office, which was turned over to me in July, 1902, on my appointment to that bureau. Under my instructions I was obliged to return to Manila on or before the 1st of December, 1902, and accordingly had but two months in which to complete my work at Buitenzorg, arriving there on September 14 and leaving November 14.

In addition to identifying as far as possible over 1,000 botanical specimens that I took with me, I also compiled data regarding 's Lands Plantentuin or Botanical Institute, notes on methods pursued in investigating the forest flora of Java, general care

of botanical material in the Tropics, notes on literature essential for work on the Philippine flora, copies of papers on the flora, and notes on descriptions of Philippine plants in old or rare publications which are not available in Manila. The general report on these investigations has been published as Bulletin No. 1 from the forestry bureau.

EXPLORATIONS.

During the past year it was my desire to spend considerable time in the field in exploration, for the purpose of collecting botanical material; but, with the great amount of office work, this was found to be impracticable, and, accordingly, but four trips were made, one to the island of Culion, December 10, 1902, to January 3, 1903; one to the island of Paragua, February 10 to March 3, 1903; to Mindoro, March 31 to April 15, 1903; and to Lamao River, Mount Mariveles, province of Bataan, Luzon, June 12 to June 15, 1903.

INVESTIGATIONS IN THE ISLAND OF CULION.

On December 10 I left Manila on the coast-guard steamer *Negros*. This trip was disappointing from a botanical standpoint, due to existing conditions. En route a stop was made at Apo, a small islet in Mindoro Straits, but the visit yielded nothing of special botanical interest. This island is perhaps three-fourths of a mile long, partly coral and partly volcanic formation, without water, and at no point more than 60 or 70 feet above the level of the sea.

Twenty-four species were secured here in condition for identification, but all of them were species of wide distribution—mostly of the strand and mangrove vegetation. The common species on the island were the strand plants, *Tournefortia argentes*, Linn. F.; *Scaevola koenigii*, Vahl.; *Spinifex squarrosus*, L.; *Euphorbia atoto*, Forst.; *Cyathula prostrata*, Blume; *Ipomoea pes-caprae*, L.; *Cassyta filiformis*, L.; *Panicum repens*, L.; *Wedelia asperima*, Benth., etc. In the interior is a mangrove swamp containing species of *Rhizophora*, *Ceriops*, and *Bruguiera*. Other common species on the island were *Thespesia populnea*, Corr.; *Psychotria malayana*, Jack; *Phyllanthus reticulatus*, Muell. Arg.; *Premna* sp.; *Flagellaria indica*, L.; *Sterculia fetida*, L.; *Ficus indica*, L.; *Aleurites moluccana*, Willd., etc.

From this place we proceeded to the town of Coron on the island of Busuanga. The only things of interest collected here were *Croton tiglium*, L., extensively used as a poison for killing fish, and *Cassia alata*, L., much used by the natives as a medicinal plant.

From Coron we proceeded to the town of Culion, on the island of Culion, where I collected in the vicinity of the town for an hour or two, then proceeding to Halsey Harbor, on the west side of the island. There, using the steamer as headquarters, I collected in the vicinity of the harbor from December 11 to 14, when the steamer left, and then went into camp with the party left to begin work on the leper colony, where I remained until January 3, then returning to Manila.

At the time the steamer left Halsey Harbor I had collected practically all the plants available in that region. The season was exceedingly dry, and few plants were in fruit or flower. A diligent search at all available points failed to bring to light more than 100 species, after the departure of the steamer, and the total number of species secured during the entire time, from December 10 to January 3, was only about 219. Under favorable conditions for collecting—that is, at a proper season—and with a boat by means of which one could move from place to place about the bay and river, I should have been able to collect at least 600 species in that time on the island of Culion, and in a richer botanical region one should secure 800 or 1,000 species in a month.

Botanically, the island of Culion is very poor, although some forests of large-sized trees occur there; the greater part of the forests, however, consist of small worthless trees. Several large, open, grassy valleys exist, which are, however, very poor in botanical material, and even in the ravines along the streams there is by no means the variety of vegetation that one would expect in such localities.

From the standpoint of a country for grazing purposes, the island is far inferior to the grazing lands of Nueva Ecija, Nueva Vizcaya, and Isabela, in regard to available area of grazing land, quantity and quality of the forage available, and the question of water supply. Isolation as a protection against such diseases as rinderpest and surra, the scanty population of the island, and the comparatively confined areas over which the cattle can graze, are points to be considered in connection with the selection of stock farms and cattle ranges.

INVESTIGATIONS IN PARAGUA.

On February 10, 1903, at the request of the superintendent of government laboratories, I left Manila in company with several other gentlemen to investigate the gutta-percha and dammar industries in Paragua. En route, one day was spent at Culion, where I collected 34 species of plants, different from those secured on this island in December, 1902, the season (February) being far more favorable for collecting in this locality than it was in December.

At daybreak on the 13th we left Halsey Harbor, Culion, for Puerto Princesa, arriving there at 8 a. m. on the 14th. Here in the morning I botanized in the vicinity of the town, and in the afternoon left with the party to investigate the dammar deposits in the vicinity of Mount Pulgar, across the bay. We ascended Ewig River by boat, arriving shortly before sunset at a small native village, where we camped for the night, leaving early the following morning for the dammar mines, the trail for several miles being along the bed of a rough, turbulent stream. Shortly after noon we left the bed of the stream and commenced the ascent of a very steep mountain, attaining an altitude of 1,700 feet, the region of the dammar deposits, where we camped over night.

Dammar is the product of a coniferous tree, *Agathis loranthifolia*, Salsb., large numbers of which were observed in this locality. One tree which we felled measured 175 feet in height and nearly 3 feet in diameter. This dammar is a resinous deposit from the bark of the tree, produced in great abundance when the bark is wounded, soon hardening upon exposure to the air and becoming more or less transparent. The best quality of dammar is found in the ground, about the base of dead trunks or where trees have stood and long since entirely disappeared. Often large quantities of dammar are found buried in the ground, and it is difficult to conceive how such great masses could be deposited from wounds in the bark of the roots or trunk of a single tree.

These dammar deposits are discovered by the natives, who travel around the region where agathis grows, constantly thrusting a sharp, hard stick into the ground until they strike a deposit, which they then gather and sell to Spanish, Chinese, or Moro dealers in the coast towns.

Agathis loranthifolia is widely distributed in Paragua, there being more or less trade in dammar in nearly all of the coast towns. At Mount Pulgar it was not observed below an altitude of 1,700 feet, and at San Antonio Bay we had to ascend to an elevation of over 2,000 feet before specimens were found. It is very safe to assume that the species is not found below an altitude of 1,500 feet in Paragua, but we had no opportunity to determine the higher limits of the altitude to which it extends.

During the trip up the Ewig River and while in the mountains I secured specimens of all species of plants observed in fruit or flower, but was unable to make careful search for the more rare species, because of lack of time. We left our camp at the dammar deposits about noon on the 16th, returning to the steamer at Puerto Princesa that night, and at 10 a. m. on the 17th we left for Separation Point, arriving at 5 p. m. on the same day.

At Separation Point is a small army post, there being a small Moro village a few miles inland. At this place the mountain range, extending the length of the island, is broken for several miles, the highest hills here being only 400 feet in altitude. The military authorities have built a trail across the island at this point, about 18 miles, to Alphonso III on the north coast.

On the morning of the 18th I went inland about 11 miles on the trail, but found comparatively little of interest. The country is covered with a dense growth of small trees, the average height not exceeding 25 feet. In the interior, however, about 10 miles from the coast, are found many very large trees.

At daybreak on the morning of the 19th we left Separation Point, arriving at San Antonio Bay at 1 p. m. the same day, spending the afternoon making friends with the Moros and arranging for a trip inland. Early on the morning of the 20th we started inland, traveling 6 or 8 miles, and camping for the night at an altitude of about 1,000 feet. On the following morning we ascended to somewhat over 2,000 feet to inspect the dammar trees, returning to our camp for lunch and then continuing on back to the coast.

At San Antonio Bay, in ascending the mountain, I had the misfortune to strain a tendon in my foot and at the same time to develop a case of blood poisoning, resulting from infection of a chafed place on the same foot, and while I was able, with a little trouble, to return to the ship, I was practically confined to my bed for the remainder of the trip.

At daybreak on the 22d we left San Antonio Bay, continuing to Clarendon Bay, Balabac Island, arriving there at 1 p. m., where the party remained until the after-

noon of the 23d, then starting on the return trip. On the 24th we were obliged to put into Separation Point for shelter on account of the high seas, leaving at daybreak on the 25th for Puerto Princesa, arriving there in the afternoon and leaving that night for Halsey Harbor, Culion, reaching there at 4.30 p. m. on the 26th. We were obliged to remain until the morning of the 28th on account of the rough weather outside, leaving then for Malampaya Bay, Paragua, which we reached in the afternoon of March 2, when we left for Manila, arriving there at 9 p. m. on March 3.

AGRICULTURE.

From an agricultural standpoint little can be said regarding Paragua. The island is very rough and mountainous, for the most part covered with dense forests, which, in many localities, are very difficult to penetrate on account of the topographical features of the country and the dense undergrowth, rendering it necessary for one to cut his way in the forests. The island supports a very small population, the few small towns being scattered along the coast. In the northern coast region the inhabitants are of the Visayan tribe, while in the southern coast region only Moros are found. The interior is occupied by one or two wild tribes of which little is known; the greater part of the inhabitants, however, belong to the Tagbanua tribe.

Rice is raised only to a limited extent, as is also Indian corn.

Camotes are found in cultivation throughout the island, and these products, together with bananas, plantains, cocoanuts, and fish, form the chief subsistence of the people.

Forest products.—There is considerable trade in the forest products—beeswax, dammar, and other gums, except gutta-percha—these articles for the most part being gathered by the Tagbanuas, who trade them for cloth, iron, knives, etc., with small dealers in the coast towns.

Cocoanuts.—Cocoanuts thrive remarkably well in the island, the only considerable number, however, being in the vicinity of Puerto Princesa, though the trees are found throughout the region inhabited by the Visayans, Moros, and Tagbanuas, and, wherever observed, they were in very thrifty condition and fruiting abundantly. Great tracts of land especially adapted to the culture of cocoanuts exist at San Antonio Bay.

Cacao.—The only cacao seen was at a small town on the Ewiig River, but there were only a few trees, evidently grown only for local consumption. The trees were in excellent condition, however, and fruiting abundantly.

Abaca.—Abaca was found in a wild state in the mountains at San Antonio Bay, but only in limited quantities. No attempt is made to cultivate it in the island.

The chief source of wealth in the island for some years must come from the forests, either in forest products (such as dammar, beeswax, gums, resins, etc.) or from the timber, or both. The forests in the northern part of Paragua contain many magnificent and valuable trees, and, considering forestry conditions in the Philippines, are comparatively easy of exploitation. In southern Paragua the forest conditions did not appear so favorable, the trees being on an average smaller. There are, too, large areas of comparatively level country; and many of the hillsides are open land, covered with tall grasses, and only a few scattered trees.

Botanically this island is most interesting, as it connects the flora of the central Philippines with that of northeast Borneo; comparatively little is known regarding it, as no extensive collections have been made on the island. What little material has been collected previously on the island has been secured in the region of Malampaya Bay and Puerto Princesa.

Owing to my unfortunate accident at San Antonio Bay, I was unable to collect more than about 250 species. Practically all of these, however, were unrepresented previously in the herbarium of this bureau, and when worked up will certainly yield much of interest.

INVESTIGATIONS IN MINDORO.

On March 31, at the request of the director of the government laboratories, I left Manila, in company with Dr. P. L. Sherman of the same bureau, to investigate the occurrence of india-rubber plants in Mindoro, spending two weeks on the trip, traveling entirely around the island and also visiting Lubang Island, returning to Manila April 15.

At all points where stops were made botanical material was secured, but, from the nature of the trip, little time could be given to this work.

INDIA RUBBER AND GUTTA-PERCHA.

The vine producing india rubber seems to be distributed throughout the island of Mindoro, but is especially abundant in the dry forests of the southern part. Specimens were secured at Bulalacao in the south, and in the Baco River Valley in the

north. The presidente of Caguray had specimens of the vine, latex and rubber, and said it was abundant in the hills back of the town. At Bulalacao it was especially abundant. No specimens were discovered in fruit or flower, but the plant is doubtless a species of *Urceola*. Without fruit or flowers it is impossible to identify the plant further, but Governor Offley has promised to have the natives search for the plant in fruit and flower and secure perfect specimens for purposes of accurate identification.

The natives have no conception of the value of the rubber, and no attempt is made by them to collect the latex other than in small quantities for medicinal purposes, the gum being placed over sores and wounds, its curative property probably being due to the fact that it protects the injured tissues from the air and prevents further infection from outside causes. This rubber plant is a twining woody vine, 40 to 50 feet in length, and from one-half to three-fourths of an inch in diameter. The latex is gathered by cutting slashes in the bark and gathering the milky sap in small vessels. The gum is produced entirely in the bark, and, from experiments made by Doctor Sherman in the government laboratories, the bark yields 10 per cent of pure india rubber of excellent quality. To secure all the rubber in the bark, it should be macerated or finely ground in a stream of hot water, the water carrying away the particles of bark and other debris, leaving the pure coagulated rubber. The latex secured by the natives by slashing the bark is coagulated by boiling for a few minutes. To secure all the rubber in the plant, the vine should be cut and the bark removed and treated as above mentioned. Cutting the vine does not kill the plant, as it quickly springs up again from the roots. Even on ground that had recently been cleared and afterwards burned there were many young plants springing from the old roots and stumps.

It is very probable that good grades of gutta-percha will also be found in the island, but in the rapid survey made of the island no first quality gutta-percha was found. At Palauan we found trees of *Palauquin latifolium*, Blanco, but the gutta-percha produced by this species is of inferior quality. This tree is abundant in that locality, and is quite generally distributed throughout the northern parts of the Philippine Archipelago.

AGRICULTURE.

But little can be said regarding the agriculture of Mindoro, for, although this island is one of the richest in natural resources in the Archipelago, it is entirely undeveloped. There are a few small towns along the coast. The interior is entirely unexplored and unknown, being almost inaccessible, due to the vegetative and topographical conditions. Mindoro is inhabited by Tagalogs, Visayans, and Ilocanos along the coast, while the interior is sparsely populated by a little known tribe, the Mangayanes.

Abaca.—Abaca is extensively grown, especially on the northern coasts, but the cultivation of this staple crop is desultory, the natives extracting only enough fiber to supply them with money sufficient for their immediate needs. The Baco River Valley is apparently an especially fine abaca region.

Cocoanuts.—Cocoanut trees are very common along the coasts, about the towns, being especially abundant about Calapan and Baco. No copra, however, is prepared in Mindoro, the mature nuts being shipped to Batangas.

Rice.—The cultivation of rice is largely confined to the upland variety, there being little paddy land on the island. The production of rice does not supply the needs of the people, and much is imported from Batangas and other places.

Miscellaneous.—As usual, about the Philippine towns, one finds in cultivation small quantities of cacao, camotes, bananas, squashes, radishes, peppers, beans, etc., these being raised for local consumption only.

CATTLE.

Cattle and carabao have been thinned out by rinderpest, and there are few horses in the island. In southern Mindoro are extensive areas of excellent grazing land, which are claimed by the friars.

AGRICULTURAL LANDS.

As noted above, excellent grazing lands are to be found in the open country in southern Mindoro. The northern part of the island is more or less mountainous and covered with dense forests. The Baco River Valley is especially rich, but at present is covered with a dense growth of timber.

LUBANG ISLAND.

The northern part of this island is a beautiful farming country and is under comparatively close cultivation. The land is, for the most part, fenced in, and fair roads

exist. Many carabao, cattle, and horses are to be found here. There has been no rinderpest on this island. The southern part of this island is mountainous and covered with forests, supporting a scattered population.

BOTANICAL COLLECTIONS AND GENERAL NOTES ON THE BOTANICAL REGIONS VISITED.

The number of species collected on the trip was 177, enough material of each species being secured to make from 4 to 12 specimens. With the exception of the Bacó River region, conditions were decidedly unfavorable for making large collections, as, owing to the unusually prolonged dry season, few species were to be found in fruit or flower. Collections were made at Calapan, Bacó, the Bacó River Valley, Mansalay, Caguray, and Palauan, on the island of Mindoro, and at Lubang and Looc, on the island of Lubang. At no other place than the Bacó River were we able to penetrate the interior more than a mile or two, on account of lack of time. On the Bacó River we went perhaps 12 or 15 miles from the coast, reaching the vicinity of the foothills of Mount Halcyon. Calapan affords very good collecting in the vicinity of the town, the surrounding country being partly open, partly forested. North of the town there are extensive areas of level country and, south, low rolling hills. Pola and Naujan, judging from what one could see from the boat, should be especially interesting botanical regions, as at these places are both plains and hilly, wooded country. Pinamalayan is also a magnificent botanical region. The southern part of the island is much drier and more open than the northern part, and of quite different formation. The country was exceedingly dry at the time of our visit, but Mansalay and Caguray should be interesting regions, botanically speaking, if one were to go there at the proper season.

The most interesting botanical region, after that of Bacó River, is Palauan in northwestern Mindoro, at the base of Mount Calavite. While Mount Calavite is by no means a high mountain, it must be an especially rich botanical region, as the forests on the mountains can not but be very damp, as the configuration of the country, together with the tides and currents, cause this mountain to be shrouded in mists a large part of the time. Evidently the ascent of Mount Calavite would be comparatively easy from Palauan. Moreover, trails exist from Palauan south to Manburso and west through a mountain pass to Abra de Ilog on the north coast. The Bacó River country is, however, by far the richest in vegetation of any seen in the island. This river rises in the foothills south of Mount Halcyon, which is nearly 9,000 feet high, and the second highest mountain in the Philippines. The river has several tributaries and it is possible to ascend many miles in native boats, through a broad valley where there is evidently a heavy annual rainfall, caused by the effect that Mount Halcyon has on the climate. The valley is covered with a dense forest, abounding in magnificent trees and a great profusion of woody vines, lianas, and various classes of epiphytes. Botanically speaking, Mount Halcyon is probably one of the best regions in the Philippine Archipelago; but the ascent of the mountain is most difficult, largely due to its inaccessibility, as it is twenty or more miles from the coast, with no trails leading to it. The mountain may be accessible by way of the north branch of the Bacó River, ascending as far as possible by boat and then following up the river valley on foot.

South of Mount Halcyon is another mountain three or four thousand feet high, and the north branch of the Bacó River flows from the valley between this mountain and Mount Halcyon. The slopes of Mount Halcyon are very steep and covered with dense forests. Leeches are very troublesome in the dark, damp forests, but by the use of proper repellents they doubtless can be avoided. I have been unable to find any record of anyone who has made the ascent of Mount Halcyon; but, with sufficient time and good equipment, I believe the ascent of this mountain to be feasible, and such an ascent could but yield a great number of interesting and unknown species.

Lubang Island yielded many interesting specimens, both in the vicinity of the town of Lubang in the north and at Looc in the south. The northern part of the island is a large plain, for the most part cultivated. The southern part is occupied by forest-covered mountains, perhaps two thousand feet in altitude.

INVESTIGATIONS AT LAMAO RIVER, MOUNT MARIVELES, LUZON.

At the request of Captain Ahern, chief of the forestry bureau, I went to Lamao River, June 12, 1903, in order to examine the region and report on the feasibility of establishing there a station for investigating the forest flora of the region, returning to Manila June 14. While there thorough botanical collections were made and notes and data prepared on the nature of the country, which have been incorporated in a report to the chief of the forestry bureau. The country is for the most part covered with a dense forest and there is little or nothing of botanical interest in the region.

FORAGE SUPPLY OF MANILA.

No report has been prepared on this subject as yet, although much data has been compiled. From preliminary observations on this subject it appears to me doubtful if hope can be entertained of improving the present supply of forage, the present supply being on the whole superior to that of most other cities of like size in the East, both in quantity and quality.

The present sources of supply can be classed as domestic and foreign, the former to include the various species of grasses utilized uncured and unhulled rice (palay), the latter to include all grains, hay, etc., imported from America, Australia, and Asia.

Like other cities in the East, the chief forage for cattle and horses in Manila is grass, which is cut fresh each day and sold by various local dealers to supply the daily needs of the city. Nowhere in the Philippines is any attempt made to produce hay; yet it seems possible that hay farms in the vicinity of Manila would be both successful and profitable. Cured hay could not be kept long in the stack, as it would soon mold, and to prevent this it would of necessity have to be baled soon after curing.

The chief source of the forage supply of Manila is the grass commonly called "zacate" (*Homalocenchrus hexandrus* (L.) O. Kuntze), which is extensively cultivated in the vicinity of the city, large areas having been adapted to the cultivation of this grass. It is grown in shallow water, in paddies, very similar to those prepared for rice culture, and Manila is probably the only city in the world where the culture of this grass is largely carried on.

The origin of the method of cultivating this grass is obscure, but it has probably been developed in Manila to meet the conditions existing here. The grass is a native of the archipelago, and is also found in tropical and subtropical regions throughout the world. In making inquiries in Manila regarding the cultivating of this grass I find that some of the older residents here have the impression that this grass was introduced from Mexico; but this, I believe, is improbable, and, moreover, Dr. E. Palmer and Mr. C. G. Pringle, who have made extensive botanical collections in Mexico for many years past, both inform me that they have never found this grass cultivated in Mexico.

In discussing the grasses utilized in Manila, but one species, *Homalocenchrus hexandrus*, need be considered, although, to a very small extent, Bermuda grass (*Cynodon dactylon*) is used, and also one or two other species found growing in the old moat surrounding the walled city. In the provinces, Bermuda grass is the most extensively used for forage, although in some sections sorghum, Indian corn, etc., are utilized, while rice straw is used to a limited extent.

So long as the forage supply of the city is fresh grass probably no better species can be found than that now in use, as it is apparently never harmful to cattle or horses. Other species (*Panicum maximum*), which might be cultivated under conditions similar to those essential for the cultivation of *Homalocenchrus hexandrus*, often cause poisoning when fed at certain seasons.

To better the forage supply of the city it would seem to be advisable to establish at some accessible locality near the city a station for testing various forage crops on a large scale, with a view to determining the adaptability of the various standard forage crops to the conditions existing here and selecting the most promising species for cultivation.

Inquiries and observations have been made regarding the forage supply in various cities in the East and, on the whole, conditions are very similar to those existing in the vicinity of Manila. Little or no hay is produced, but that used is imported from more temperate countries. The chief forage used for native cattle and horses is various species of grasses, either wild or cultivated, and which are fed green.

At Hongkong much forage is imported, the only species cultivated there for forage purposes being "guinea grass" (*Panicum maximum*), which is utilized in a green state. Various species of wild grasses are also used.

In Singapore reliance is placed almost entirely on wild-growing grasses for the forage supply of the city, little or no attempt being made to cultivate forage grasses. Dr. H. N. Ridley, director of the botanical garden at Singapore, informs me that *Homalocenchrus hexandrus* and *Isachne australis* are the two chief forage grasses, but *Panicum maximum* and *Panicum muticum* are somewhat cultivated. *Panicum maximum* is dangerous when fed to horses in large amounts and has caused the death of many in Singapore. When used this grass is mixed with the better varieties. Chief dependence is placed on the wild grasses, *Leersia hexandra* and *Isachne australis*, growing in the swampy fields, which are, so to say, kept up for the purpose of producing forage.

In Java, at Batavia and Buitenzorg, *Cynodon dactylon* is apparently the most exten-

sively used forage grass, although other species are utilized more or less. So far as observed, no attempt is made at either place to cultivate any forage crops, dependence being placed on the wild-growing species.

In British India, very full information regarding the various forage grasses has been secured, for which I am indebted to Dr. D. Prain, director of the Royal Botanic Garden at Calcutta, whose letter on the subject is given below:

ROYAL BOTANIC GARDEN,
Silpur, Calcutta, May 29, 1903.

DEAR SIR: In reply to your letter of March 18, 1903, regarding the forage supply of Calcutta and other Indian cities, I beg to inform you that in the neighborhood of Calcutta no systematic cultivation of forage plants takes place. In the neighborhood of Calcutta during the past fifty years individual gentlemen have cultivated more or less successfully patches of lucerne (*Medicago sativa*), teosinte (*Euchlaena luxurians*), and guinea grass (*Panicum maximum*). The authorities of the remount depot have also, to my knowledge, grown patches of *Panicum muticum*, and recently several people have been trying *Paspalum dilatatum*. Two other grasses that have, during the past one hundred years, been introduced, and in all likelihood purposely introduced, are *Panicum flavescens* and *Pennisetum borbonicum*, both of which are now quite naturalized, but neither of which so far as I know are cultivated now. But for ordinary purposes, and even to meet the wants of the cavalry garrison, it is found that the supply of forage provided by the wild grasses growing in the vicinity of the city is ample, and the conditions of Calcutta may be said in reality to be exactly those of Singapore. The grass which the native grass cutters, who bring in this forage, prefer to obtain is Bermuda grass (*Cynodon dactylon*), but this in the Delta of the Ganges is not so plentiful as it is in most parts of India, and various species of *Oplismenus* and *Panicum* probably bulk equally largely in the Calcutta forage supply. Hardly any hay is made or used. The most prevalent grass near Calcutta is *Imperata arundinacea*, but it is not used for forage more than can be avoided.

In Madras conditions are practically the same as in Calcutta, the cultivation of grasses being mainly confined to inclosures around the houses of Europeans, and the species grown being the same as those noted above. In Madras, however, teosinte (*Euchlaena luxurians*) is not a favorite grass, being there considered rather injurious to animals, especially horses. The sewage farms near Madras grow grasses systematically, but they only find a sale for the forage during the hot season, when wild forage is somewhat scarce. At other times they have to make all the grass they grow into hay, which is mainly taken up by the Government commissariat department, but is not used by the general public.

In Rangoon the conditions are exactly the same as at Singapore. No grasses are cultivated by anyone, but wild species are collected for use in the fresh state and are, to some extent, made into hay.

I regret that for Bombay I can give no definite information.

Turning now to northern India, where the conditions are different from any of the seacoast places mentioned and where the dry weather is accompanied by a greater degree of drying up of vegetation, I find that at Allahabad, at Agra, at Lucknow, at Cawnpur, and at Saharanpur dependence is placed entirely on wild species. Even in places like the large remount depot at Saharanpur, where large quantities of grass and hay are required, the local supply of wild grasses is found sufficient, and in places like Allahabad, Lucknow, and Cawnpur, where there are government grass farms, the grasses there grown are entirely native species. On damp ground one finds patches of *Imperata cylindrica*, as in the lower Gangetic Plain, but on the dry ground the prevailing grass is Bermuda grass (*Cynodon dactylon*), associated with four or five species of *Andropogon*. As one passes westward and southward from the upper Gangetic Plain, e. g., to Delhi and beyond, one finds that the *Cynodon* still prevails, but there the *Andropogons* are replaced by species of *Pennisetum* and *Cenchrus*. In the cold season these grasses, except *Cynodon*, yield little or no fodder, since even when perennial they dry up and give only an annual turf. In the grass farms I have mentioned it is found that shallow plowing is a good thing, but to apply manure is bad, since the desirable *Andropogons* tend at once to disappear and to be replaced by coarse and undesirable annual species of *Panicum* and *Sorghum*.

In not a few parts of the drier portions of upper India the common sorghum (*Andropogon sorghum*), which is largely grown for its grain, is also cut green as a cattle food. I hear, however, that some, if not all, of the forms of sorghum possess the property of forming cyanogen and are at least "suspicious" as a green fodder. This is apparently authenticated as regards Egypt, but as regards India it is, so far, only a matter of surmise.

In the vicinity of Lahore, and near other cities in the Punjab, where the conditions of the upper Gangetic Plain are intensified, wheat, barley, and oats are all

grown as forage plants for horses (cut green), as well as for their grain. In addition to these, green rape (*Brassica napus* var. *dichotoma*) and "moth" (*Phascolus aconitifolius*) are largely used for feeding cattle, but not horses, the former in the cold weather, the latter in the hot season.

I regret that I have been so long in answering your inquiries, but in order that the information supplied you might be absolutely reliable, I have submitted the question to local officers throughout India, and the delay has been due to my not getting replies sooner from some of the parties consulted.

Yours, very truly,

DAVID PRAIN.

ELMER D. MERRILL, Esq.,

Botanist, Department of the Interior, Bureau of Agriculture, Manila, P. I.

MISCELLANEOUS WORK.

In the compilation of data by other employees of this bureau regarding fiber plants, food plants, fruits, etc., for the ultimate purpose of preparing publications on the same, I have necessarily given considerable attention to the scientific identification of many of the species. The identification of such material is usually unsatisfactory, for it is rare that complete specimens are submitted for naming. Identifications have also been supplied to the superintendent of government laboratories, and also to Mr. Webb, the entomologist in the same office, while the microscopic work of Mr. Eaton, of that office, on the Philippine timber trees has been dependent upon identifications that the botanist has supplied the chief of the forestry bureau.

In June, 1903, shortly after my return from Lamao River, I submitted to the chief of the forestry bureau a working plan for prosecuting the proposed forest-flora investigations at that place, modeling my plan after that adopted by Doctor Koorders in his work of a similar nature in Java.

During the past nine months a series of germinating experiments have been carried on, using chiefly seeds of various native-tree species. This work has been done on a small scale, and has not been entirely satisfactory.

Respectfully,

ELMER D. MERRILL, *Botanist.*

Prof. F. LAMSON-SCRIBNER,

Chief Bureau of Agriculture, Manila.

EXHIBIT E.

REPORT OF THE EXPERT IN FIBER INVESTIGATIONS.

MANILA, August 31, 1903.

SIR: I have the honor to present herewith the following report of the work of the division of fiber investigations of this bureau for the period commencing December 15, 1902, the date of my appointment as expert in charge of fiber investigations:

This division was organized on July 1, 1902. In the report of the expert in fiber investigations, submitted on September 4, 1902, the following outline was given of the plans for future work:

1. The correspondence and consultation with fiber dealers in Manila, for the purpose of introducing, promoting, and collecting promising fibers.
2. The planting and propagation of fiber-producing plants, for the purpose of study and experimentation.
3. The collection and description of commercial fibers and fiber products.
4. The collection and description of fibers not commercially known.
5. The study of the physical and chemical properties of fibers.
6. The investigation of the conditions and possibilities for introducing fiber plants not already cultivated in the islands.
7. The consultation of customs authorities relative to kinds and quantities of fibers exported and imported.
8. The investigation of leaf and bark materials used for mats, hats, and other articles.
9. The investigation of the genus *Calamus* (rattan) for new and useful species.
10. The compilation and preparation of reports on these fiber-plant investigations.

During the months of July, August, and September a preliminary investigation was made of the more important fiber plants of the islands. The results of this investigation were published in a pamphlet entitled "A Preliminary Report on the Commercial Fibers of the Philippines." A collection was also started of fibers and fiber products. A circular letter containing questions relating to fiber plants was issued and widely distributed, and a compilation was made of books and papers

relating to the subject of fibers and fiber plants, with a view of securing the same for the bureau library.

On September 30, 1902, the work of this division was temporarily checked, owing to the resignation of Mr. John W. Gilmore, the expert in charge of fiber investigations, but was again taken up on December 15. On December 28, 1902, letters were received by the insular bureau of agriculture from the United States Department of Agriculture, Washington, D. C., in which it was stated that large quantities of manila hemp of a very inferior grade were being received by the importers in the United States, and requesting that a special investigation be made of the hemp industry, with a view of regulating the production or the exportation of this inferior grade of fiber.

Upon the receipt of this communication the matter was referred by the chief of the bureau to the fiber division, with instructions to conduct an investigation for the purpose of determining the causes of the production of fiber of an inferior quality, the most practicable means of improving the quality of fiber produced, and the best method of preventing or of regulating the exportation of fiber of an inferior grade. This investigation was at once undertaken, and covered a period from January 2 to March 2, 1903. A thorough inspection was made of a number of the largest abaca plantations in several different provinces. The hemp warehouses, where fiber is baled and stored, were visited, and many of the leading producers and buyers of fiber in the islands were consulted. An endeavor was made to determine the relative degree in which the quality of the fiber is affected: (1) By the methods of growth and cultivation of the plant; (2) by the different processes of separation and cleaning; (3) by the handling and treatment of the fiber after it is separated from the plant. The following is an outline of a special report relative to this investigation, which was published in the Official Gazette:

The more important qualities which determine the value of abaca fiber are strength, color, length, and texture. The most valuable grades of fiber are often 10 or 12 feet in length, of a white, glossy appearance, possessing great strength, and of clean, even texture. From this best grade of fiber, which is classed commercially as "superior," we find all degrees of inferiority in which the fiber is lacking in some one or all of the qualities above mentioned. The causes which produce this difference in quality may be traced from the earliest stages of the plant's growth to the time when the fiber is ready for market. They may be enumerated as follows:

1. By a difference in the species of the plant which produces the fiber.
2. By the methods of cultivation and the care of the plant from the time of planting to the time of cutting.
3. By the age and condition of the plant at the time of cutting.
4. By the injurious action of insects or plant diseases.
5. By the time which is allowed to lapse between the cutting of the plant and the stripping of the fiber.
6. By the method which is used in separating the fiber from the pulp of the plant.
7. By the methods used in drying the fiber.
8. By the injurious action of rain or salt water upon the fiber while it is being transported from one place to another.
9. By the condition of the fiber when it is baled and also the methods of baling.
10. By the length of the time of storage after the fiber has been baled.
11. By any artificial treatment or doctoring of the fiber, to increase its weight or improve its appearance.

There are several different species of the hemp plant and many different varieties. In each fiber-producing district we usually find three or four varieties which are largely cultivated. While these different varieties produce fiber varying somewhat in quality, with proper care and attention they may all be made to yield a fiber of good color, strength, and texture.

The cultivation of the land and the care of the plant, by giving it suitable protection from excessive sun and wind, have a very important effect upon the quality of the fiber produced. If the plantation is allowed to grow up to weeds and vines, the hemp plants will be small and the fiber obtained weak and of a poor quality.

The proper time for cutting hemp is after the flower has appeared and before the fruit has developed. If cut either before or after this period the fiber obtained will be of an inferior quality. Unless under continual supervision, the native laborer is very careless in his methods of working and will often fail to use any judgment in the selection of plants for cutting. During the past few years, while hemp fiber has commanded a high price, many plantations have been very closely worked and many imperfectly developed plants have been cut and stripped of fiber.

The injurious action of insects or of plant diseases, as far as observation has been made, seems to be very slight. The young plants are occasionally destroyed by a borer, but comparatively few plants are thus attacked, and the total amount of injury is small.

The time which is allowed to elapse between the cutting of the plant and the

stripping of the fiber has an important effect upon the quality of the fiber produced. If the plants are allowed to remain lying upon the ground for any considerable length of time, the sap of the plant is absorbed by the fiber, producing both weakness and bad color. The fiber should be separated within twenty-four hours after the plant has been cut, or, at the longest, within forty-eight hours. If allowed to remain upon the ground for a longer period than this, the stem becomes partially rotted. This rotting makes the stripping of the fiber a much easier process, but results also in the production of a very inferior product.

Of the several causes which produce a difference in the quality of fiber, undoubtedly the most important is the manner in which it is separated or extracted from the plant. Up to the present time no machine has been perfected for doing this work, so that practically all of the abaca fiber in the market is extracted by the primitive method of drawing the strips of the plant containing the fiber between a knife or bolo and a block of hard wood. The plant is cut close to the ground, and a portion at the base, about 1 foot in length, is cut off. The leaves are then removed near the point where they branch out from the stem. The leaf petioles which surround the central stem of the plant are split tangentially to separate the outer portion, which contains the fiber, from the mass of pulp or pith. These fiber strips are quite thin and are from 3 to 4 inches in width.

The cleaning machine is very simple, consisting of a knife fastened upon a horizontally placed block of wood, the knife being held down upon the block by a bamboo spring and raised by means of a foot lever. The fiber strips are drawn under this knife, which separates the pulp and leaves the fiber in the hand of the operator. The two parts of the process which affect the quality of the fiber are the degree of pressure which holds the knife upon the block and the condition of the edge of the knife which is used. If the knife is held loosely, a great amount of pulp is left on the fiber, resulting in coarseness and dark color. The condition of the edge of the blade, however, has an even more important effect upon the quality of the fiber. A smooth blade produces a fine fiber which, other conditions being satisfactory, will be of good color, strength, and texture. A knife having a serrated edge produces a coarser fiber, of poorer color, strength, and texture, the degree of inferiority depending upon the degree of serration of the knife blade. The more deeply serrated the knife the less difficult is the work of fiber extraction, and a correspondingly increased amount of fiber is produced. For these reasons a serrated knife is almost universally used through the islands. In many districts the teeth of the blade are so coarse as to produce a fiber of very inferior quality. It is claimed by the users of such knives that the saving in time and the increase in the amount of fiber produced more than compensate for the loss in quality and consequent decrease in value. It should be noted, however, that in such calculations the effect which is produced on the world's markets for Manila hemp by the sale of this immense quantity of inferior fiber is not taken into consideration.

It is believed that the only experiment that has been made under Government supervision, for the purpose of demonstrating the relative value of the smooth and serrated blade for stripping hemp, was one conducted at the town of Gubat, in the province of Sorsogon, on February 8, 1903. In this experiment 30 hemp plants were used, which yielded fiber strips weighing 130 pounds. This amount of fiber strips was equally divided, one half being cleaned with a smooth blade and one half with a serrated blade. The fiber produced was carefully dried under cover. When dry it was assorted into commercial grades and weighed. The results were as follows:

Knife with smooth blade:

Grade fiber produced—

Very superior, 2½ pounds, at \$31 per picul	\$0.553
Superior, ¾ pounds, at \$27.50 per picul.....	.147
	<hr/>
	.700

Knife with serrated blade:

Grade fiber produced—

Good second, 4½ pounds, at \$23 per picul.....	\$0.698
Low third, 1 pound, at \$19.50 per picul.....	.139
	<hr/>
	.837

Time required with smooth blade.....minutes..	55
Time required with serrated blade.....do.....	45
Gain in value of fiber using serrated blade.....per cent..	19.56
Gain in time using serrated blade.....do.....	18.18
	<hr/>
Total gain in favor of serrated blade.....do.....	37.74

The above experiment served to demonstrate (1) that from an equal number of plants, using a serrated blade, more fiber can be produced and with a less amount of work than when using a smooth blade; (2) that the same part of the same plant will produce either a very superior or a very inferior quality of fiber, depending upon the knife which is used; (3) that in this particular experiment the financial value of the fiber produced because of its increased weight from a given number of plants was considerably greater when using a serrated knife than when using a knife with a smooth blade. In view of the fact that an enormous quantity of inferior fiber is being produced from plants which are capable of yielding a very superior quality of fiber, that this inferior article threatens to seriously affect the world's market for Manila hemp, and that the production of this class of fiber is largely due to the kind of knife which is used, it is deemed that this question is one that should be a matter of careful experiment, and, if practicable, of Government regulation.

Hemp fiber is ordinarily dried by being hung over bamboo frames erected near the cleaning shed, the time required, under favorable conditions, being from four to six hours. By this method the fiber is often wet by the rain and is thereby more or less injured. If means could be devised for covering the fiber with a light roof of nipa or canvas during showers and light rains, a great saving in time would be effected and a better quality of fiber would be produced.

After being stripped and dried, the fiber has to be transported from the plantation to some point of shipment. This is usually over rough mountain trails or up and down the coast in small native boats. In this way the fiber is frequently wet, either by rain or salt water. In the former case, if promptly dried, no serious injury results. If wet by salt water, however, the fiber may be greatly injured, and when wet in this way, it should be thoroughly washed with fresh water before being dried.

That the fiber is often insufficiently dried and that it is frequently baled in this condition is undoubtedly one cause of the inferior fiber reported from Washington. If dry and in good condition the fiber is not injured by the process of baling and does not deteriorate in value during any reasonable period of storage.

It is not deemed probable that any considerable amount of fiber is artificially treated or doctored. In the provincial towns fiber is often brought in for sale in the evening, being purposely exposed to the action of the dew to increase its weight, and in some instances, to accomplish the same result, it is imperfectly protected from the rain. No cases have been observed where other methods of doctoring than with water have been used.

While all of the reasons previously referred to are doubtless responsible, in some degree, for the production of inferior fiber, it is believed that the three which are of the greatest importance and which are also the most easily subject to regulation are: (1) Improper cultivation, allowing the plantation to grow up to coarse weeds, thus checking the growth of the hemp plants and weakening the fiber; (2) improper extraction, allowing a large amount of pulp to remain on the fiber, thus producing weakness and dark color; (3) improper drying, allowing the fiber to be baled when moist, thus producing a partial rotting and a resulting weakness and dark color.

The best means of increasing the production of a superior quality of abaca fiber and the methods of regulating the production of inferior grades are suggested by the causes which produce the inferior product. Such action can only be successfully carried out by the cooperation of the producer, the exporter, and the Government bureau.

On the plantation more attention should be given to the cultivation of the land, keeping the hemp clean and free from weeds and vines. The native laborer should be under much more thorough supervision in all departments of his work than is the case at the present time. Such supervision should aim to prevent the cutting of the plant before it is developed, or allowing it to remain too long before cutting; the leaving of the plant for any length of time upon the ground after it has been cut and before the fiber has been separated; the use of deeply serrated knives for stripping the fiber; carelessness in drying and handling the fiber after it has been stripped.

With the buyer and exporter the matter is one of classification and baling. If it be true that hemp fiber is being received in the United States, in which the outer part of the bale contains a good quality of fiber and the inner part of the bale inferior fiber, and even stones, it indicates that there is either great carelessness or else misdirected attention in this department of the industry. Aside from the ordinary care necessary to produce bales of fiber of reasonably even quality and up to a certain standard, special attention should be given to prevent the baling of fiber before it has been properly dried.

Government action may be conducted along several different lines. A more thorough botanical study should be made of the different species of the hemp plant, which may serve to show those of greatest value and also those best suited to the different parts of the Archipelago.

An entomological study should be made to determine what insects are injurious to the hemp plant and the best means of destroying them. A series of experiments in stripping hemp with different knives should be made. Experiments should also be conducted with a view to determining, if it is practicable, to protect the fiber from rain during the period of drying.

As a means of improving and developing the hemp industry in the Philippine Islands and, also, of regulating the quality of fiber which shall be produced and exported, the following recommendations are respectfully made:

1. That a government experiment station be established in one of the hemp-growing districts where such experiments can be conducted in the cultivation of hemp and the extraction and treatment of hemp fiber, as may be deemed advisable.

2. That a series of experiments be conducted in separating hemp fiber with different grades of cleaning knives. For such experiments at least four knives should be used, viz, a smooth blade, a finely serrated blade, a medium serrated blade, and a coarsely serrated blade. These experiments should be conducted at some central point in each province, or in each district, where a large amount of fiber is produced, and the results of the several experiments carefully compared. Such experiments would serve to show definitely the amount, the quality, and the value of the fiber produced by the different grades of knives, and would demonstrate whether or not it is advisable to regulate the use of these knives by government action.

3. That some action be taken to encourage the invention or perfection of a machine for separating hemp fiber. Such a machine would not only be of great value as a means of increasing the output of this valuable staple, but would also be a means of regulating the quality of the fiber produced, and would in a large measure solve the labor question in so far as it is related to the production of Manila hemp.

4. That a government classification of fiber be established, and that all fiber exported be inspected by government inspectors and marked according to this classification.

5. That, when it shall have been determined by experiment what grade of knives can be most advantageously used in separating hemp fiber, the use of more coarsely serrated knives shall be forbidden by law, and all fiber produced by such knives shall be destroyed.

6. That an investigation be made of the system of fiber inspection now in force in New Zealand, and that if such a system is found to be practicable and suited to the conditions now prevailing in these islands, the production of Manila hemp, the baling, marking, and exporting of the same be subject to a system of government inspection.

In connection with this special investigation relative to the production of inferior fiber a general inspection was made of the hemp industry. The provinces of Camarines, Albay, Sorsogon, Masbate, Samar, Leyte, Cebu, and Iloilo were visited, and much valuable data was obtained relative to the different species of abaca, soil and climatic conditions, planting and propagation, cultivation, extraction and drying of fiber, transportation facilities, local uses of fiber, and the possible utilization of waste products.

At the present time Manila hemp is the most important agricultural product of the Philippine Archipelago, and its production is the leading industry of the islands. The reasons why this industry has attained its present proportions are twofold. In the first place, the existing natural conditions are peculiarly suited to hemp production. The conformation of the land, the composition of the soil, and the climatic conditions all unite to make certain parts of the Philippines a nearly ideal hemp-growing country. Secondly, the requirements of the crop are well suited to the local industrial conditions. No skilled labor is required, and only the simplest forms of tools, implements, and machinery. The plant needs but comparatively little care and attention, and does not suffer serious injury when entirely neglected for a considerable period of time.

With the future development of the islands, the production of other agricultural staples, as sugar, rice, coffee, tobacco, and cotton, is bound to increase greatly. If abaca is to continue to hold its present place as the leading product, and to compete successfully with the other commercial fibers of the world, it can only be by the improvement of present conditions and the introduction of new methods. The opportunity for the development of new hemp-growing territory in the islands is almost unlimited. Thousands of acres of land not under cultivation now produce more or less wild hemp, while there are great areas at present covered with forests which, when cleared, will be suitable for hemp.

A more careful selection of the species of hemp grown, and improvements in the methods of cultivation will greatly increase the yield per acre. In the extraction, drying, baling, and transportation of fiber there is opportunity for great improve-

ment. The perfection of a machine for the extraction of hemp fiber, more than any other one thing, will tend to develop the industry.

The conditions in the provinces are very encouraging. New hemp plantations are being started and old plantations, which have been allowed to run to waste during the insurrection, are now being reclaimed. Among the producers there seems to be a very general desire for progress and the improvement of present conditions; especially is this true as relates to the perfection of a machine for extracting fiber. More capital, improved labor, and better roads are all needed. As these gradually come, we may expect to see substantial progress.

On March 5, 1903, instructions were received from the chief of this bureau to collect and prepare a fiber exhibit for the Louisiana Purchase Exposition. Preliminary to making such a collection, the following outline of a fiber exhibit was prepared and submitted to the exposition board in Manila:

FIBER EXHIBIT OF THE PHILIPPINE ISLANDS.

A. Material for the exhibit.

1. Maps: A series of maps of each island and province, which shall show the relative production of the various commercial fibers in the different parts of the islands.

2. Photographs:

(a) Of growing fiber plants.

(b) Of scenes illustrating the extraction of fiber and the manufacture of fiber products.

(c) Of various fibers and of fiber products.

3. Herbarium: To include specimens of all plants in the islands which produce a fiber, having either a local or a general use; also of plants which produce a fiber not now used, but which promises to be of value.

4. Collection of fibers (to be divided into five classes):

(1) Bast fibers (e. g., ramie fiber).

(2) Woody fibers:

(a) The stems and twigs of exogenous plants used for weaving or basketry.

(b) The root of exogenous plants used for tie material.

(c) The wood of exogenous trees, easily divisible into layers or splints.

(3) Structural fibers:

(a) Derived from the structural system of the stalks, leaf stems, and leaves (e. g., abacá, maguey, piña).

(b) The whole stems or the split leaves of monocotyledonous plants (e. g., rattan, buri, pandan, nipa).

(4) Surface fibers (e. g., cotton).

(5) False fibrous material (e. g., mosses, certain leaves, seaweeds, and fungous growths).

The more important commercial fibers of the islands, viz, abacá, maguey, ramie, piña, cotton, buri, pandan, nipa, and rattan should be represented by a large collection, showing all the different commercial grades, the amount of fiber produced by a single plant, the amount produced on a given area, and the different qualities produced by different methods of extraction.

Special attention should be given to securing a large collection of the different varieties of rattan and of rattan products.

5. Collection of fiber products:

(1) Spinning products—

(1) Fabrics—

(a) Fabrics of the first rank, as fine and coarse textures for wearing apparel, house furnishings, sails, etc.

(b) Fabrics of the second rank, as burlap, coarse bagging, etc.

(2) Laces and nettings—

(a) Laces.

(b) Coarse nettings, as all forms of nets, hammocks, etc.

(3) Cordage—

(a) Threads, yarns, cords, lines and twines.

(b) Ropes and cables.

(2) Tie material: Coarse material prepared from the bark of trees, used for constructing fences, huts, rope bridges, etc.

(3) Natural textures: The thin smooth strips of tree basts, sometimes stripped and used as a substitute for cloth.

5. Collection of fiber products—Continued.

(4) Brushes—

(1) Brushes manufactured from fiber.

(2) Brooms and whisks.

(3) Very coarse brushes and brooms used for street sweeping, etc.

(5) Plaited products:

(a) Articles of attire, as hats, sandals, etc.

(b) Mats, matting and thatch, as sleeping mats, screens, thatch.

(c) Baskets and bags.

(d) Miscellaneous manufactures, chair bottoms, cigar cases, etc.

(6) Forms of filling—

(a) Stuffing or upholstery for filling cushions, pillows, mattresses, etc.

(b) Calking material for filling the seams of vessels.

(c) Packing for bulkheads of vessels, machinery, etc.

(7) Paper—

6. Tools, implements, and machinery: To include all of the various tools, implements, and machinery used in the planting and cultivation of fiber plants, in the extraction and handling of fibers, and in the manufacture of the various fiber products.

As a means of further illustrating the details of the fiber industry in the Philippine Islands it is recommended that the following operations and processes be represented at St. Louis by working models, to be operated by Filipinos, using the raw materials of the islands in the manufacture of Philippine products:

B. Industrial operations to be conducted at St. Louis.

1. Production of abacá fiber: To consist of a model shed constructed of bamboo and nipa, which shall contain the usual apparatus for stripping hemp, having one knife for stripping the class of fiber ordinarily used for cordage, and one for stripping the fine fiber used for textiles; also arrangements for drying fiber, and a small press.
2. Production of piña fiber: To consist of the apparatus used in separating and drying piña fiber.
3. Production of cotton: Illustrating the crude methods of separating the fiber from the seeds.
4. Production of nipa mats: Illustrating the method of making and of drying the nipa mats used in the construction of nipa houses.
5. Manufacture of cordage: Showing the native methods of twisting fibers and of preparing the coarse bast fibers for withes and cables.
6. Manufacture of textiles: Consisting of looms for weaving the different native textiles—piña, jusi, sinamay, etc.
7. Construction of nipa houses: Consisting of materials and arrangements for the construction of the various kinds of nipa houses.
8. Manufacture of hats, mats, bags, nets, and other fiber products.

Owing to the illness of the expert in charge of fiber investigations, the work of collecting this exhibit did not commence until June 10, 1903. A compilation was then made of the different classes of fiber material which has already been received by the exposition board, and a collecting trip was made in the Visayan Islands, covering the period from June 12 to August 6. The provinces visited were Iloilo, Antique, Capiz, Negros Occidental, Surigao, Misamis, Bohol, Cebu, Leyte, and Samar. The material collected included various specimens of fibers, more especially the different grades of abacá, piña, and jusi used in the manufacture of fabrics; a collection of native fabrics, including piñas, jusis, sinamays, and cottons, together with articles made from these fabrics; and a collection of plaited material, including hats, mats, bags, baskets, cigar cases, etc. In addition to this material, large collections have been received from the provincial officials of the different islands, which, when properly classified and prepared, will very satisfactorily represent the fiber industry of the islands.

The more important work of this division during the past seven months has been in connection with the special hemp investigation and the collection of a fiber exhibit. An endeavor has also been made to carry on, as far as practicable, the several lines of investigation as outlined in the first part of this report. Many letters have been received, both from correspondents in the islands and also from the United States, requesting information relative to the fiber industry in the Philippines. Our collection of fibers and fiber products has been materially enlarged and now numbers 145 specimens, all of which have been loaned the exposition board as a part of the fiber exhibit. Thirty-three books and three magazines, relative to the growth of fiber plants and the production of fibers, have been ordered from the

United States, and will form a part of the bureau library. Circular No. 3, containing a list of inquiries relative to fiber plants, has been widely distributed throughout the islands, and the numerous replies which have been received to this letter contain a large amount of valuable data and information.

The outline of the work of the fiber division covers in a general way the plans for future work. It is deemed, however, that the following matters are of especial importance and should be given first attention:

1. The establishment and equipment of a station where field experiments can be conducted in growing different species of abacá. The production of abacá occupies such an important position among the agricultural interests of the islands that any experimental work which shall materially benefit this industry will be of very great value. At such a station experimental work could also be carried on in extracting, drying, and testing fiber.

2. The establishment and equipment of a station where field experiments can be conducted in growing cotton. The possibilities of the more extensive cultivation of cotton in these islands is a matter which should receive a careful and thorough investigation. In view of the fact that cotton is now successfully raised in small amounts in many different parts of the islands is an indication that, with the introduction of new varieties of seed, improved methods, and American machinery, this crop may be made one of the important staples of the Philippine Islands.

In connection with the field work with abacá and cotton there should also be collected and propagated as many as possible of the other fiber plants of the islands. Many of these plants which now have only a local use are very promising, and with proper cultivation might prove worthy of a wide distribution.

3. An investigation of the uses, value, and possible utilization in these islands of cocoanut fiber or coir. In India and in other countries where the cocoanut is grown coir fiber forms an important article of commerce. In the Philippine Islands enormous quantities of this fiber are allowed to go to waste which, if collected and properly treated, might form an important source of wealth.

Respectfully,

H. T. EDWARDS,
Expert in Fiber Investigations.

Prof. F. LAMSON-SCRIBNER,
Chief Bureau of Agriculture, Manila.

EXHIBIT F.

REPORT OF SUPERINTENDENT OF EXPERIMENT STATION AT MALATE.

MANILA, August 31, 1903.

SIR: I have the honor to submit herewith a report of the work of this station for the period ending August 31, 1903. The report covers a period of eight months, the time during which I have been in charge.

STATION GROUNDS.

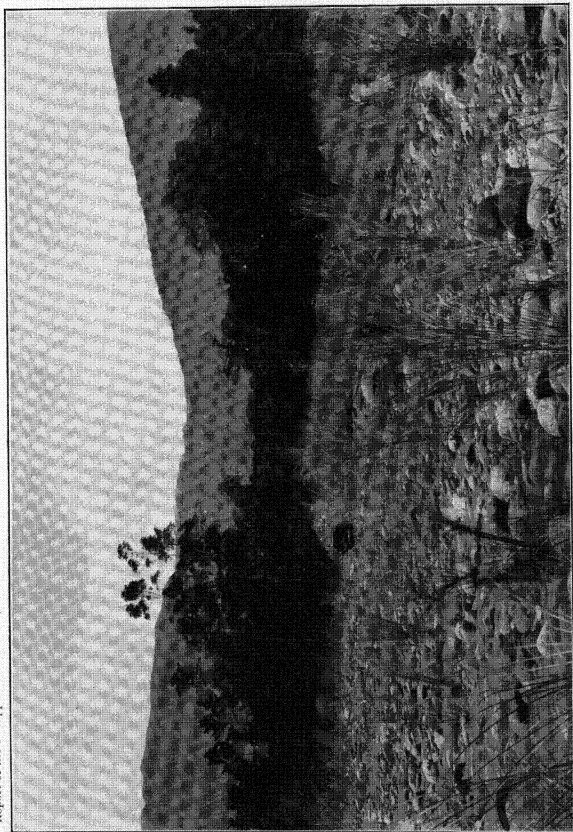
The experimental grounds of the station contain in all 12 acres, 8 of which lie north of Calle San Andres; the remaining 4 acres are on the south side of the street. At the beginning of operations here the land on the north side of the street was in "rice paddies," dotted about here and there with stone foundations, marking former sites of buildings of various descriptions.

These foundations were of stone and solid masonry, extending about 3½ feet below the surface of the ground, which necessitated considerable labor in removing them. The material taken from these foundations was used in grading the roads about the premises. One of the largest, situated near the center of the field, was left standing, with a view to utilizing it in the future as a base of a reservoir.

The land on the south side of the street was in much better condition, having been used during the past two years for growing nursery stock and gardening purposes. The soil is a sandy loam, with an average depth of 4 feet; below this there is a grayish-black sand, which, in the absence of any clay subsoil or hardpan, affords fine natural drainage.

IMPROVEMENTS.

During the year two new buildings were erected by the bureau of architecture—one, a barn for the stock, containing in addition a seed room and storerooms for the farm implements; the other, a water tower for the irrigation system, has just been completed.



MOUNTAINS OF INTERIOR OF MINDORO.

These buildings are ornamental as well as useful, and add much to the appearance of the station grounds. The well for the irrigation plant was dug early in March, the work being done by our own laborers under the direction of the gardener. The flow of this well has an estimated capacity of 7,500 gallons of water daily.

In order that work might be carried on during the rainy season with as little interruption as possible, ditches and drains have recently been dug sufficient to carry off the surplus water quickly.

INSECT PESTS.

Insects have been a serious menace to the work and are responsible for many of the failures recorded in the following notes. Ants were especially troublesome, destroying the seed immediately after planting before they had time to germinate. Repeated attempts to start lettuce, onions, and beets in plant beds resulted in failure on this account. It was found necessary to plant in boxes, protected from the ants, and afterwards transplant in permanent seed beds. This method, while involving a little more labor than direct planting, has proven quite satisfactory in the end. Injury from insects has not been limited to the ravages of ants only. Aphides and mealy bugs have been equally troublesome. The former confined their attacks mainly to the leguminous plants. The yield of both lima and string beans was materially reduced by them. The vitality of the vines of lima beans was so weakened by their attacks that frequently only one or two beans to the pod could be found. Mealy bugs do not confine their attacks to any particular species of plants, but are found on all deciduous trees and nursery stock. Tomatoes and eggplants seemed to have suffered most from their attacks. Fully 25 per cent of the tomatoes were destroyed by worms, which ate their way into the fruit, causing it to decay and drop from the vines before maturing. Hand picking seems to be the only way to protect the plants from attacks of worms, as they can not be reached by sprays.

VITALITY OF SEEDS.

Many seeds rapidly deteriorate in vitality in a tropical climate. This fact has recently been demonstrated at the station. Late plantings show that many of the seeds now on hand are worthless, while only a few months ago seed from the same stock germinated perfectly.

Attention has previously been called to this fact, and it has been suggested that this was the reason for the heretofore spasmodic planting of garden seed by the people of these islands. This experience suggests the idea that it may be advisable for this bureau to grow its own seeds, at least such as deteriorate rapidly in vitality in this climate.

CULTIVATION.

Work was begun on the grounds October 22, 1903, and in preparing land for cultivation, the ridges or dikes of the paddies on the north side were leveled with a 1-horse scoop and shovels, then broken to a depth of 6 inches with a sulky plow drawn by 4 horses. Later it was broken several times with a 2-horse Oliver plow and thoroughly harrowed.

During the dry season all crops were planted on a level, and the same plan strictly adhered to in cultivation, the work being done mainly with fine-tooth cultivators, and keeping a blanket of 2 or 3 inches of finely pulverized soil on the surface. This method of cultivation serves a twofold purpose in keeping down the weeds and at the same time preventing the rapid evaporation of moisture from the soil.

During the rainy season the method of cultivation is being reversed; instead of planting on a level, all crops are put in on ridges 12 to 14 inches high, the ridges leading into drains large enough to rapidly carry off all surplus water.

In the early spring months the land was fertilized with stable manure at the rate of 40 cords to the acre and plowed under. A casual comparison of the crops now growing with those grown previous to the use of the fertilizer clearly demonstrates the value of its application.

Since the beginning of operations in October experiments in gardening have been conducted continuously for the purpose of determining what vegetables can be grown here and the proper time for planting them. In every instance the experiments were made as practicable as possible and complete records kept of the operations and results.

EXPERIMENTS DURING THE DRY SEASON.

Small plats of each variety were grown, and successive plantings made at intervals of every few weeks. This plan was followed throughout the dry season.

The best results were obtained during the cooler months of January and February. From this it may be expected that better results will be secured from plantings made

earlier, or during November and December. Fair crops were grown during the hot months of March, April, May, and June. The experiments showed one thing conclusively—that shade is necessary during the hot season. Better results are obtained during the cool season by giving the plants protection from the sun until they have made some growth.

Many of the vegetables grown were superior to any seen on the markets of Manila, whether home-grown or imported. No finer specimens of lettuce, eggplants, and beets can be seen anywhere than those grown at this station. Asparagus have done remarkably well. Seeds sown February 1, 1903, and transplanted July 1, are producing "shoots" large enough for use. It takes two years, at least, to accomplish the same result in a temperate climate.

Cauliflower was a complete failure; although the plants made a good growth, not one ever showed any tendency to head. Turnips and large-seeded rape were destroyed by aphides. Spinach and rhubarb, planted in November and protected by shade, made little growth. The results do not justify repeating the experiment with either rhubarb, spinach, or cauliflower. Two varieties of pepper—"Red Chile" and "Ruby King"—have produced good crops, and were comparatively free from insect attacks. "Red Chile" is the earlier and more prolific of the two varieties. The test of pease was very encouraging. Although planted late in the season, good crops were produced by two varieties—"Bliss Abundance" and "Burpee's Early Dwarf." The former was decidedly the more prolific. The pease were injured slightly by insects. After the first picking, "Burpee's Early Dwarf" was destroyed by blight. Three varieties of string beans—"Dwarf Wax," "German Wax," and "Burpee's Green Pod Stringless"—were given a trial. All three bore fair crops, but suffered for lack of sufficient moisture. The "Burpee's Stringless" continued bearing longer than the other varieties, was a more vigorous grower, and seemed better adapted to this climate. Irish potatoes made a fair growth. The first plantings had to be destroyed just as they were showing bloom, in order to make room for a new building. The plants had set a fair crop of small potatoes. A later planting of "Washington Seedling" blighted badly. The plat of sugar cane was a failure, due partly to the fact that the ratoons were badly eaten by ants when planted. The teosinte and cotton were dwarfed during the dry season from lack of moisture. Okra, a vegetable belonging to the mallow family, produced an abundant crop without irrigation. Several plantings of watermelons, cucumbers, squashes, and muskmelons resulted in failure. In the first planting watermelons and muskmelons were destroyed, after blooming and setting a good crop, by a bacterial disease similar to that described by Doctor Wilson, of Washington, D. C., as "muskmelon wilt." Squashes and cucumbers made a good growth and bloomed freely, but set very little fruit. The injury to these was due mainly to a cucumber beetle, closely resembling the one so troublesome in the southern portion of the United States. The cucumbers and squashes produced enough fruit to justify the opinion that good crops can be grown here by using liberal applications of insecticides at the proper time.

Of the clover and forage plants which were given a trial, teosinte and alfalfa seem to be the most promising. Both alfalfa and teosinte require constant irrigation. The check plat, which was not watered, made little or no growth during the dry season. After the first cutting of teosinte, a new growth of 8 inches was made in one week. At this rate the crop can be cut every six weeks, which will give about eight crops a year. The plats sown to Egyptian and Italian clovers were failures, as the seed did not germinate. The stand of sulla was not very good, but was allowed to remain. Millet, given two trials, seeded at a height of 4 inches. The dwarfing was due, no doubt, to insufficient moisture. Soy beans attained a height of 14 inches and produced an average crop. Velvet beans made a vigorous growth of vines without irrigation.

The following vegetables have been grown successfully at this station from American seeds:

Tomatoes.	Squashes.	Pease.
Onions.	Cucumbers.	Asparagus.
Lettuce.	Eggplant.	Celery.
Radishes.	Pepper.	Sweet potatoes.
Lima beans.	Okra.	Beets.
String beans.	Sweet corn.	

In connection with the work in gardening, experiments were carried on with cotton, jute, corn, tobacco, sesamum, coffee, and tropical and American fruits. As much attention as could be spared from this work has been given to the growing of nursery stock for distribution and for use at this station. It is intended to establish at this station a small orchard containing a few of the best varieties of deciduous and citrus fruit trees, grapes, and other small fruits, with a few specimens of each of the

native plants of economic importance. A good start has already been made on this work. Six thousand coffee plants, including several of the best varieties, have been grown for distribution. Four thousand of these were recently shipped to Batangas, to be used in establishing a coffee plantation under the direction of the bureau.

The dry weather, together with the inadequate supply of water on the premises for irrigation purposes, necessarily limited operations to some extent. It is expected that this difficulty will not be encountered during the next dry season, when the irrigation system now under construction will furnish abundant water for all purposes.

SPECIAL CROPS.

Teosinte.—From the table given below it will be seen that five cuttings were made from the plat in eight months, which is equivalent to nearly eight cuttings a year. The total yield of the five cuttings is 49½ tons green and 10½ tons dry fodder per acre, or at the rate of 80 tons green and 16½ tons cured fodder per acre for the year. It is only fair to add here that the above figures are very low estimates. The second and third crops were damaged fully 50 per cent by locusts, and the four crops were obtained during the dry season, which was of unusual severity. This experiment shows that, on well-fertilized land, with frequent irrigation, ten crops can be grown in one year, with a yield of 135 tons green and 30 tons dry fodder per acre.

The following is a record of the yield and dates of cutting:

Date of cutting.	Height.	Yield per acre.	
		Green.	Dry.
	<i>Feet.</i>	<i>Tons.</i>	<i>Tons.</i>
March 21	5	12	2
April 20	2½	5	1½
May 18	2	4	1
June 29	5	12½	2½
August 10	6	16	4
Total		49½	10½

The high price of teosinte seed and the great demand for it in the islands suggests the advisability of growing a small area for seed purposes. The plat produced at the rate of 800 pounds of thoroughly cleaned seed per acre. At 60 cents gold per pound (the wholesale price of seed in the United States), the value of the crop from one acre is \$480. Three crops of seed can easily be grown on the same ground in one year, which would mean a return of \$1,440 per acre.

Two acres of teosinte were planted June 6. Owing to the dry weather prevailing at that time the seed did not germinate until June 20. Previous to planting the land was fertilized with 40 cords of stable manure to the acre, which was plowed under. Only two cultivations were given—the first June 29 and the last on July 7, at which time the teosinte was large enough to completely shade the ground. On August 10 one-tenth of an acre was cut and yielded 3,440 pounds of green fodder, or at the rate of a little over 17 tons to the acre. At the time this plot was cut the average height of the teosinte on the two acres was 6 feet. Five days later (August 15) another tenth acre was cut, yielding 5,395 pounds, or at the rate of nearly 26½ tons to the acre. This tenth of an acre was cut near the center of the field, and may be taken as a fair average for the two acres. On August 19 the teosinte averaged 8 feet in height. The crop is being sold as fast as cut, at \$10 gold per ton. This gives a return of \$265 gold per acre for each cutting. Allowing eight cuttings per year, which have been obtained here on a smaller area, the gross receipts at this rate from one acre would be \$2,120 gold per year.

Experiments have also been made with cowpeas, soy beans, clovers, alfalfa, and velvet beans. Of these alfalfa and velvet beans have given the best results. A plot of alfalfa, sown January 6, has been cut three times to date, the last cutting yielding at the rate of 2 tons green and 1,300 pounds dry per acre. One acre was sown to alfalfa July 14. The seed made a good start, but heavy rains occurred before the young plants were well established, making reseeded necessary.

Sesamum indicum.—The experiments with this plant have been highly satisfactory. Two crops have been grown and harvested, and the third, planted July 6, is now (August 30) 4 feet in height. The drought-resisting qualities of the plant, its immunity from insect attacks and diseases, the little cultivation required, and the ease with which it may be harvested and prepared for market, readily commend it as a staple crop of these islands. The yield of the first crop from a one-sixth acre plot was 180 pounds (82 kilos) of cleaned seed, or at the rate of 1,080 pounds (492 kilos) per acre.

The value of sesamum seed, according to figures furnished by the American consul at Marseilles, France, is \$4 to \$7.90 gold per hundred kilos. The gross value of our crop at the lowest price quoted is \$19.68 gold per acre; at the highest price, \$38.87 gold per acre. At least three crops can be grown on the same land in one year. At the above figures the returns from one acre would be from \$59.04 to \$115.58 gold. These figures may be taken as a very low estimate. They are based on the results of a crop grown on poor soil, with no fertilizer or irrigation. If the above results can be obtained under such unfavorable conditions we may expect much better returns from a crop grown on good land with proper cultivation.

Sugar cane.—Our first planting of sugar cane was not satisfactory, the ratoons being seriously damaged by insects. Sugar canes have been reimported anew from the Sandwich Islands, and, through the kindness of Prof. Jared G. Smith, of the United States Department of Agriculture's experiment station in Honolulu, the bureau has obtained a supply of five of the best varieties in use for commercial planting in those islands. Most of these have made an excellent growth, and will be available for distribution by the next cane planting season.

Cotton.—One experiment with the ordinary varieties of cotton was made during the dry season. The plants did well until they arrived at the fruiting stage, when all blighted and shed both foliage and fruit. Blight-resisting varieties would no doubt do well here, and better results would follow if planted at other seasons of the year.

Jute.—Two crops of jute have been grown, the object being to determine its value, both as a dry and wet season crop. Jute stands the drought well, and is comparatively free from insect attacks. While the plant withstands the drought, the rapid growth of the crop recently planted indicates that better results will be obtained from the wet season crop. It is now (August 25) nearly 6 feet high.

The enormous quantity of jute fiber required in America (all of which is now being imported from India), for wrapping the entire cotton crop as well as for sacking a large portion of the grain crop, seems to justify the statement that the imports of jute to the States exceed in value those of Manila hemp. This fact alone is sufficient reason for giving this crop a thorough trial.

Experience has shown that diversification of crops is a good policy to follow in agriculture; hence, every profitable crop which can be added to the list grown here will strengthen the resources of the Philippine planter.

TOBACCO EXPERIMENT.

A one-tenth acre plot was planted to Sumatra tobacco. It was intended to grow one-half of this plot under shade; but the structure erected for this purpose being very light, was destroyed by the winds during the month of March, and this feature of the experiment had to be abandoned. The seed was sown January 14, and transplanted to the plot February 14. At this time there was little or no moisture in the ground. As a precaution, the plants were set late in the afternoon and abundantly watered. Cut worms destroyed many of the young plants, which necessitated resetting the plot several times. Owing to the difference in the age of the plants, the crop did not mature uniformly; hence, the entire crop could not be harvested on the same date. The plants were set 18 inches apart, in rows $3\frac{1}{2}$ feet apart. Very little cultivation was required in growing the crop. Stirring the soil once a week with a fine-tooth cultivator was sufficient to keep it in good condition. The plot was irrigated every day until the plants were large enough to shade the ground, after which very little watering and no cultivation were necessary. On May 7 the first cutting was made. Owing to the irregularity in planting, only about half of the plants were fully ripe at the time. It requires some experience to determine just when a crop of tobacco is ready to cut. Usually the plants take on a yellowish-green color and the leaves are dotted with lighter colored specks. The tobacco was cut and handled in the same manner in which it is usually done in the tobacco growing districts of the States.

The stalk was first split from the top to within a few inches of the ground, with a heavy knife, and then cut off. As soon as cut, the plants were hung on bamboo sticks 3 feet in length, six stalks to the stick, and immediately carried to the shed. If the tobacco is allowed to remain in the sun here after cutting, even for a very short time, it is ruined. Such precaution in a temperate climate is not necessary. In fact, the planters in the States prefer to have the tobacco wilt before putting it in the barns, as the leaves are less apt to be broken or damaged in handling.

On July 7, two months from the date of the first cutting, the tobacco was stripped and graded in the following way: The best 14-inch leaves graded as No. 1; 12-inch leaves as No. 2, and the short leaves and trash as No. 3. The only difference between Nos. 1 and 2 is in the length of the leaves; both will make fine cigar wrappers.

Nearly all the crop graded as Nos. 1 and 2. No. 3 will make good fillers or smoking tobacco.

	One-tenth-acre yield.	Rate per acre.
	Pounds.	Pounds.
No. 1.....	38	380
No. 2.....	47	470
No. 3.....	12	120
Total.....	97	970
Second crop:		
No. 2.....	30	300
No. 3.....	50	200
Total.....	80	500

From the above figures it will be seen that the total yield for the two crops was at the rate of 1,470 pounds per acre. The crop was not planted until February 14, two months later than it should have been planted. The experiment shows that, if planted at the proper time, two good crops, and probably three, can be grown in one season from the same planting, allowing full time for cutting and curing before the rainy season begins.

The crop has not yet been disposed of, so it is impossible to estimate its value in this report. It is certainly unsurpassed by any grown in the islands at the present time, judging by the samples for the St. Louis exhibit. The leaves are exceedingly thin, elastic, light colored, with a fine silky luster. In fact, it has every appearance of the finest cigar wrappers.

Considering the unfavorable conditions under which this crop was grown the results are very encouraging, and seem to warrant further and more extensive trials with growing Sumatra tobacco at this station.

FRUIT-BEARING TREES AND VINES

During the current season importations were made from Japan of enough evergreen and deciduous fruit trees to plant about 2 acres of the station grounds. Selection was made of such varieties as were known to thrive in widely separated extra tropical regions and in some instances to have been successfully introduced into the Tropics. The importation referred to consisted of 20 Japanese plums, 20 mammoth chestnuts, 10 grapevines, 10 pomegranates, and 120 orange trees, which were planted on January 2, 1903, in a rather light soil. Grapes, pomegranates, and oranges have made a creditable growth, the drawbacks of a season of abnormal drought duly considered. Japanese plums exhibit a remarkable and unexpected vitality. The constant attacks of leaf-eating insects compelled continual recourse to arsenical sprayings, and many of the trees have successfully withstood the combined ravages of both insects and poisons.

Through the courtesy of the Acclimatization Society of Bowen Park, Queensland, Australia, the bureau also received a number of bananas—typical forms of *Musa cavendishii* and *M. paradisica*. They are seemingly markedly distinct from any of the seven or eight forms cultivated in and about Manila, and are now growing with remarkable thrift and vigor.

A considerable number of *Carica papaya*, of an improved Indian variety, were reared from seeds kindly supplied by Dr. T. H. Stephens, of Cavite. A line of these has been planted along the street running through the station grounds, and the trees are growing with the luxuriance that characterizes the papaya in all tropical countries.

An *Aegle marmelos*, the Bael tree fruit of India, planted at this station more than a year ago, exhibits a strong and healthy development, and gives full promise of the adaptability of this useful fruit to the islands. The genus is represented here by two native species—both quite useless for food purposes—and the successful introduction of a desirable species is a matter for congratulation.

Small plantings have been made on the station grounds of a number of miscellaneous plants of economic value, and a few of purely ornamental interest. Among the former are Ceara rubber, gum acacia, camphor, Liberian and hybrid coffee, and rain trees; and, among the latter, a collection of Japanese bamboos, caballero trees, a number of palms, and a few native orchids.

DAILY RECORD OF EXPERIMENTS.

The following notes are taken from a daily record of the work done prior to March 26. There was practically no rainfall during the entire period.

TOMATOES.

Varieties, Livingston Perfection and Fordhook First. Seed sown October 28, 1902; transplanted to seed beds November 18; final transplanting to plots December 2-18; showing bloom January 9, 1903; attacked by tomato worms; sprayed with arsenious acid, which killed the plants.

Helios.—Seed sown November 7, 1902; transplanted December 9; January 17, 1903, one-third of the plot was trimmed and staked, one-third pinched back, and one-third left for check; January 20, showing bloom; attacked by tomato worm; sprayed with Paris green, two applications, given one week apart; February 14, tomatoes ripening, vines well fruited, 25 per cent of which were destroyed by worms; March 10, shaded portion of plot producing best quality of fruit; tomatoes blistered badly before ripening where exposed to sun.

Tree tomato.—Seed sown December 5, 1902; transplanted January 17, 1903; vigorous grower; January 30, showing bloom, but setting no fruit; March 17, the above variety had ripened; no fruit to date, March 26.

Red Cherry.—Transplanted January 17; February 10, showing bloom; March 4, first ripe tomatoes; fruit small and inferior.

Imperial.—Transplanted January 17; February 24, first ripe tomatoes; fruit good quality, but very light crop.

Ignoleum.—Transplanted January 17; February 9, showing bloom and making good growth, but setting no fruit. No fruit to date (March 26); very few green tomatoes on the vines.

MUSKMELONS.

Varieties Portuguese, San Martino, Spanish Pearl, Celeno, Therapia, and Iberia. Planted November 24, 1902; December 2, seed generally well up, Spanish Pearl under the average; December 18, showing bloom; January 12, 1903, blight appearing on vines; January 27, vines killed. Ground prepared for tobacco.

SQUASH.

Golden Custard.—Planted December 3, 1902; December 8, good stand; January 18, 1903, vigorous growth of vines, showing bloom, setting very little fruit; January 26, vines have ceased to grow; injuries of cucumber beetle very apparent; very few mature squashes on vines.

CUCUMBER.

Prescott's Wonder.—Planted January 17, 1903; seed failed to germinate; January 28, replanted to New Paris Pickling; February 9, good stand; February 26, showing bloom, but setting no fruit; failure due to lack of moisture.

WATERMELON.

Mountain Sweet.—Planted November 29, 1902; December 3, good stand; January 26, 1903, showing bloom, but very few young melons on vines; January 17, vines destroyed by blight.

Three varieties, Corean, Five Mountains, and Kishniff. Planted December 5, 1902; December 12, good stand; January 6, 1903, attacked by blight; January 17, vines destroyed by blight.

Santiago.—Planted January 28, 1903; failure on account of insufficient moisture.

SUGAR CORN.

Country Gentleman.—Planted December 27, 1902; January 7, 1903, good stand; attacked by ants, which ate the plants off just beneath the surface of the ground; treated one row with bisulphide of carbon, which stopped the injury; February 18, needing more moisture; showing tassel; height of stalk, 26 inches; March 10, ears of corn mature, small, but fairly well filled out, usually two to the stalk, about 6 to 8 inches above the ground.

COTTON.

Variety Abassy. Planted December 27, 1902; January 7, 1903, good stand; January 27, badly infested with plant lice; March 20, first blooms appearing; height of plants, 30 inches; one row fertilized with bat guano; 8 inches taller than row not fertilized.

FORAGE PLANTS.

Teosinte.—One plot planted December 5, 1902, seed failed to germinate; January 6, 1903, replanted in drills $3\frac{1}{2}$ feet apart; January 14, good stand; given three irrigations—February 21, February 27, and March 6; March 4, showing heavy bloom; height of plants, $3\frac{3}{4}$ to 4 feet. One-half of this plot was fertilized with nitrate of soda; no perceptible difference between treated and untreated lots; March 13, two rows cut; March 14, these rows putting out new growth; March 21, made a growth of 8 inches.

Alfalfa.—December 9, 1902, sown in three beds; December 18, fair stand on shaded portions of beds; January 15, 1903, showing bloom; height, 14 inches; shows effect of drought; January 6, three beds drilled; watered daily; January 13, good stand; March 6, height, 12 to 14 inches, showing bloom; March 13, two beds cut.

Kaffir corn.—Planted January 6, 1903, failed to germinate.

Sulla.—December 12, 1902, sown in three beds; December 21, very inferior stand; January 6, 1903, two beds sown in drills; January 14, fair stand; February 18, has made little growth, 6 inches.

Italian clover.—December 12, 1902, sown in three beds; failed to germinate; replanted in drills; failed to germinate.

Egyptian clover.—January 6, 1903, one plot sown in drills; seed failed to germinate.

Millet.—January 31, 1903, four rows sown in drills; February 18, good stand, but making little or no growth; February 27, showing bloom; height, 4 inches; dwarfed for lack of moisture.

Soy beans.—Variety "Teppo Mame." December 10, 1902, drilled in two rows; December 15, good stand; January 20, 1903, showing bloom; February 18, growth ceased, plants dwarfed; height, 14 inches; light crop of beans.

Lentils.—"Spanish" variety. November 29, 1902, two rows sown in drills; December 18, good stand; January 16, 1903, showing bloom; February 18, setting fair crop of beans, pods small, two or three beans in each; March 5, seed mature.

Lupine.—Planted December 26, 1902, inferior stand; January 3 to February 18, 1903, making very little growth; needing water; March 5, plants have shown no sign of bloom.

Velvet beans.—March 28, 1902, two rows planted; December 5, imperfect stand; January 15, 1903, showing bloom; attacked by caterpillars; sprayed with lime and Paris green, with good results; February 26, vines making a vigorous growth and setting good crop; attacked by aphides; March 6, beans maturing four to five in a pod; one row cut; March 16 to March 21, putting out new growth.

VEGETABLES.

Cauliflower.—Transplanted from boxes December 7, 1902; January 14, 1903, making good growth, but showing no indication of heading; February 18, attacked by "leaf spot" and cabbage worms; March 3, plants destroyed.

Cabbages.—"Montgibella." Seed sown December 6, 1902; transplanted December 16; January 1, 1903, plants making good growth, with constant watering; no indication of heading; badly infested with worms; treated with lime and Paris green; February 14, baskets placed on a few plants to force them to head; February 18, treated heads decayed; a few small heads on untreated plants. This lot of seed was evidently badly mixed; the plants show four or five distinct varieties.

Turnips.—"Early Red Top." January 3, 1903, sown in drills; January 7, good stand; January 18, made good growth until attacked and destroyed by aphides.

Asparagus.—"Columbus Mammoth." Sown December 12, 1902; seed failed to germinate; January 7, 1903, replanted, seed soaked twenty-four hours; January 13, good stand.

Radishes.—"Scarlet Button." Planted October 27, 1902; November 5, good stand; first cropping November 21.

Lima beans.—"Burpee's Dwarf." Planted December 27, 1902; January 7, 1903, inferior stand; January 26, making very slow growth, badly infested with aphides; February 4, showing bloom; February 26, setting light crop; watered daily; March 6, first picking; vines plainly show injury from aphides; pods small and frequently contain only one or two beans; rarely more than three. "Willow Leaf." Planted January 12, 1903; January 19, good stand; February 5, showing bloom; vines staked February 20; putting on good crop; badly infested with aphides; first picking of mature beans March 16.

Peas.—"Bliss Abundance." December 24, 1902, two rows planted; December 31, good stand; January 20, 1903, making very slow growth, with no signs of blooming; February 10, blooming freely; February 26, setting good crop; watered daily; February 27, peas maturing slowly; March 1, first picking; successive pickings March

7, 12, and 21; late but prolific variety. "Burpee's Early Dwarf." Planted January 14, 1903; January 19, good stand; January 26, blighting badly, showing bloom; first picking mature peas February 20; very early variety. "Early Rust Proof Wax." Planted January 14, 1903; January 20, good stand; February 14, showing bloom, making fair growth; February 26, first picking.

Eggplants.—"N. Y. Purple." Seed sown December 5, 1902; December 15, imperfect stand; January 20, 1903, transplanted to permanent seed bed; February 13, showing bloom; February 18, setting good crop; plants badly infested with mealy bug; February 21, first mature fruit gathered; plants watered twice a week; March 6, plants bearing abundantly; March 9, attacked by beetle, which is eating off the upper surface of the leaves; sprayed with Paris green; one application checked the beetles. "Stratagem." January 14, 1903, planted two rows; January 20, good stand; February 27, showing bloom, blighting badly; March 21, maturing; very light crop.

String beans.—"Burpee's Stringless Green Pod Dwarf." December 24, 1902, planted two rows; December 31, good stand; January 20, 1903, showing bloom; February 18, good crop on vines; first picking February 27, 1903; still bearing; three crops picked from vines. "Dwarf Wax." Planted January 7, 1903; January 13, good stand; February 2, showing bloom; February 18, first picking; early variety, but not as prolific as "Stringless Dwarf."

Lettuce.—"Early Curled Simpson." December 8, 1902, sown in seed beds; destroyed by ants; December 29, sown in boxes; January 20, 1903, transplanted to permanent beds; two rows shaded; February 18, forming good heads; largest and best heads on shaded beds.

Okra.—"Perkins' Mammoth." Drilled in two rows November 26, 1902; December 1, good stand; January 20, 1903, showing bloom and fruiting heavily; February 18, abundant crop; March 6, plants have been given no water, but are still in bearing; March 21, blooming and forming new crop.

Beets.—"Detroit Red." Sown in seed beds December 27, 1902; destroyed by ants; January 23, 1903, planted in boxes; February 20, transplanted to permanent bed; February 27, making good growth; March 6, plants 8 inches tall, with healthy appearance; free from insects; March 23, first cropping.

Celery.—"White Plume." Sown in boxes January 21, 1903; February 13, good stand; February 25, transplanted to permanent beds; one-half of beds shaded; March 14, plants on shaded portions of bed dying; shade removed; March 21, making very little growth; too warm at this season for celery.

SUMATRA TOBACCO.

Seed sown in boxes January 12, 1903; January 21, good stand; one row transplanted January 21; January 27, attacked by cutworms; sprayed with Paris green; March 2, height 3 feet; March 10, topped. Remainder transplanted February 24 to plot; one-half of plot shaded; March 2, injured by cutworms; sprayed with Paris green; watered every two days.

SESAMUM.

Sown in drills December 3, 1902; December 8, good stand; December 28, making vigorous growth, showing bloom; comparatively free from insects; January 19, 1903, average height of plants 3 feet; heavily seeded; February 26, seeds mature.

CONCLUSION.

Running expenses have been kept as low as consistent with the best interests of the station. The working force has been reduced from 30 day laborers to 10. It may be necessary at times to increase this number, but no more will be carried on the pay roll at any time than are needed to do the work efficiently. We are keeping four American horses at present. It is believed that now two are ample for our work, and it is recommended that the other two be sent to some other station, or otherwise disposed of. I have had no trouble whatever with labor and, generally, the men have done satisfactory work. The Filipino laborers are tractable and readily learn to handle our implements and machinery. Two of the men have been trained to do very good plowing.

The results of our experiments with Sumatra tobacco seem to warrant further trials on a larger scale. If this work is to be continued, a barn or curing shed is indispensable. I therefore recommend that a building with the proper facilities for handling and curing the crop be erected on the station grounds.

Respectfully,

Prof. F. LAMSON-SCRIBNER,
Chief Bureau of Agriculture, Manila.

THOS. L. RICHMOND, *Superintendent.*

EXHIBIT G.

**REPORT OF THE SUPERINTENDENT OF SAN RAMON GOVERNMENT FARM AT
SAN RAMON, ZAMBOANGA, P. I.**SAN RAMON, ZAMBOANGA, *August 31, 1903.*

SIR: According to instructions contained in your letter dated July 13, 1903, I herewith submit the following report:

Since the last report the value of San Ramon farm as a commercial enterprise has not changed. There is acreage enough to plant hemp and cocoanuts to such an extent that in ten years the net proceeds would more than bear the entire expense of the bureau of agriculture, as at least 250,000 cocoanut trees can be planted on soil well adapted to them, and where the best results obtainable anywhere will be evidenced. A great portion of the farm is adapted to hemp, and from this there would be a vast income. Hemp would not require more than two or three years at most for results to be obtained, and by planting in straight rows (between the cocoanuts, these furnishing the desired shade), and at least 10 feet apart each way, the ground could be worked successfully, and with modern machinery, which would be an unmistakable advantage, as one carabao and cultivator can do more work than ten natives with hoes and bolos. This amount of tree planting would necessitate a considerable outlay for a period covering two or three years. For instance, 10 or 12 good mules or horses would be required, modern machinery, about 30 carabaos, and an increased labor force, enumerating 100 natives and at least 3 Americans, one of the latter being a general utility man. In three years the force could be cut down materially and the running expenses of the farm be paid easily, and in ten years the farm could carry all the expenses of the department, as heretofore stated. If some action could be taken looking forward to these results it would demonstrate, from a commercial standpoint, the possibilities of this line of work. When Americans make an investment they invariably expect quick returns, but in this country there is this difference noticeable, the returns are slower but greater.

HEMP.

The ground for 8,000 hemp plants has been broken to a depth of 8 inches, not only broken, but pulverized, and there can be no gainsaying the fact that the plants take more kindly to it than can be imagined by careless planters. It has been fully demonstrated that the hemp should be planted in rows and the ground kept in the best condition possible. The drought of the last six months has been somewhat disastrous to hemp, but if it had been planted in rows to admit of cultivation (which would have loosened up the ground, thereby conserving the soil moisture) the result would have been entirely different. This has been demonstrated not only in arid lands elsewhere but here on the farm. In the beginning of the drought a small plot was planted, containing 2,800 plants. These were worked with hoes and cultivators, and the loss was less than 2 per cent. With the same soil and drainage in an adjacent plot (hemp in fine condition at the beginning of the drought), the loss without cultivation was not less than 70 per cent.

COCOANUTS.

The cocoanut trees are in a better condition than last year notwithstanding the drought. Sixty thousand cocoanuts were cut in the quarter ending January 30, 1903, as compared with 10,000 for the same period in the year 1902. This was due to a general cleaning up of the ground and trees. Only 2,000 trees have been planted this year, making a total of 10,700 on the entire farm.

CACAO.

The 1,012 cacao trees mentioned in my last report are all dead. This is due to neglect of trees during the period intervening between Spanish and American régime, they being unable to withstand the neglect and consequent disease. A grove of 100 trees situated on the north side of the river Sax is in very good condition. One of the houses mentioned in last year's report of buildings is situated in this tract and is occupied by a native and his family who look after the grove, keeping out the weeds, monkeys, etc., monkeys being very destructive to the young fruit, of which there is now a fair quantity.

BUILDINGS.

The storeroom and tool house, size 26 by 120, which was being constructed when the last report was sent in, is now completed; also one house for the foreman, size 26 by 26; two houses for natives, 16 by 16; one barn, 32 by 60, and one guest house, 20 by 30, used as an office.

BRIDGES.

Six bridges have been built, four of them large enough to make the construction rather expensive, as it was necessary to saw all the lumber by hand; also, the contrivance for pile driving was the crudest imaginable. It will not be necessary to construct any more bridges or buildings, except as improved conditions may demand.

REVENUE COLLECTED.

The amount of miscellaneous revenue collected is as follows:

August sale of hemp	\$193.38
August sale of copra	529.12
September sale of copra	390.15
November sale of copra	2,500.83
December sale of hemp	777.75
January sale of copra	457.90
February sale of hemp (plants)	555.00
February sale of hemp	130.87
February sale of copra	1,633.27
May sale of copra	1,584.00
Total	8,752.27

OPERATING EXPENSES.

Salaries and wages:

July	\$506.39
August	619.59
September	632.93
October	1,494.95
November	1,470.30
December	1,433.70
January	1,296.23
February	1,185.35
March	988.25
April	1,031.20
May	974.70
June	1,146.75
Total	12,780.34

Transportation: March

71.50

Contingent funds:

July	31.05
August	144.62
September	63.83
December	86.78
January	68.45
April	400.00
June	385.00
Total	1,179.73

Total 14,031.57

This includes purchase of 2 Chinese ponies, 5 American plows, and 4 carabaos.

Respectfully,

Prof. F. LAMSON-SCRIBNER,
Chief Bureau of Agriculture, Manila.

GEORGE M. HAVICE, *Superintendent.*

EXHIBIT H.

REPORT OF THE SUPERINTENDENT OF THE BATANGAS EXPERIMENT STATION.

BATANGAS, August 31, 1903.

SIR: Pursuant to written instructions, dated July 13, 1903, I have the honor to submit the following as a report of the establishment and operation of this experiment station for the past year.

Experimental work was begun at Batangas in August, 1902, by General Bell, in cooperation with the bureau of agriculture, for the purpose of determining if it were possible and practicable to grow alfalfa and other American forage crops in this

country, as the food for horses and cattle is very scarce in this province. Incidentally experiments were tried with American vegetables.

The tract of land selected was the only land available at the time, and the work of clearing and breaking it up took until near the end of the rainy season. While we did not get any very good results from the experiments, due mainly to the lack of water, it was shown that if the alfalfa were sown at the proper time and could be irrigated in the dry season, it would be a valuable crop for the islands, as it has lived through the six months of drought without any irrigation whatever.

As it was almost impossible to get water to irrigate the tract of land selected, and it was so near the new military post as to make the rental very high, it was thought best to secure a more desirable place near the town and on some of the low land, where the water would be easy of access and the land better adapted to our experiments.

The tract of land finally selected, consisting of 25 acres of low sandy loam, was secured about the 1st of February, 1903, and the work of establishing an experimental station, under the direction of Capt. D. H. Boughton, was begun. The entire farm has been inclosed by a three-strand barbed-wire fence. An 80-foot windmill (Ideal Irrigator) has been put up with two tanks, each of 1,500 gallons capacity, and the necessary pipes and attachments to run water to the different parts of the farm. This mill in a good breeze will pump 3,000 gallons of water per hour and is quite sufficient to supply water for our work.

A comfortable dwelling house and office room has been furnished for the superintendent and farm foreman, with room below for all the farm implements and machinery. A suitable barn has been furnished, sufficient for six animals and room for harness and feed. These buildings are all of native materials, such as hardwood posts, bamboo sides and floors, with nipa roofs. Two mules were also purchased by Captain Boughton and turned over to the bureau for use on the farm, and are used in doing the farm work.

Only native labor has been employed, and with practice the men have learned to use American implements and handle the team of mules with satisfaction. Up to July 1, 1903, the men were paid and all the expenses were borne by Captain Boughton, including the rental of the land for five years, for 1,700 pesos, which has been paid in advance. The money received for the sale of vegetables was also turned over to Captain Boughton and included in his report. As no money has been received or disbursed by this office, I have no financial report to make at this time.

During the clearing up of the farm to put it into working shape, from fifteen to twenty men were employed. Now ten men do the work and carry on the experiments.

American vegetables have been experimented with and a record has been kept of the results obtained, and while the record is not yet complete, as some things planted have not had time to fruit or reach maturity, some important facts have been established. It has been demonstrated that some American vegetables grow here as well as in the States, while it is very difficult to grow others, and, so far, the experiments show that some of our vegetables are a total failure in this climate, and some of our crops will only grow at a certain season of the year. While we have not been experimenting long enough to know in every case just what effect the different seasons have on all the crops, we do know that in certain cases the season plays a most important part. It has been found that certain crops did well at one time and were a total failure if planted at a different time of the year, while with some others at the first trial it was thought impossible to raise them, and at another planting good results have been obtained. It has not been our aim to make variety tests, though records are kept of the different varieties planted, and in some cases show one to be better than another, but this is not so important at this time.

The table below shows the results of our experiments with different plants, so far as they are known:

Vegetables that are a success at all times.	Vegetables that only grow well at certain seasons.	Vegetables that so far have been a total failure.
Lettuce	Tomatoes.....	Watermelons.
Red beets	Radishes	Garden peas.
Eggplant.....	Squashes	Beans (lima).
Endive	Melons ^a	Cabbage.
Salsify	String beans.....	
Peppers		
Onions		
Okra		
Carrots.....		

^a Melons would do well at the beginning of the rainy season if something could be found that would kill the worms that attack the roots. We are conducting an experiment of this kind now, and everything points to success.

Celery is not yet determined, but looks promising.

It is intended to make this chiefly a forage station, and we are experimenting with alfalfa and corn. On account of the extended drought in this province this year, we did not get sufficient rain to make a planting until about the 6th of July, and while the 7 acres of alfalfa are up and looking fairly well, it is too soon yet to know if this will be a complete success, but at the present time the prospects are good. We have one field of American corn that is looking well, the stalks being green and large, and the chances are that it will be a success. We have been troubled a good deal by the locusts, and if it were not for the constant efforts made to keep them away all the corn would be destroyed, as is the case with much of the corn belonging to natives, and where they have large fields they have to give it up. By using the large American plow and getting the land thoroughly pulverized by the disk and roller, and by cultivation and some manure, the native corn planted on this station is looking better than that on adjacent farms.

This has been a very unfavorable season for experimental work in this province. In the first place, it was very dry and hot until the 1st day of July, and then the locusts have kept us busy most of the time. So far the experiments have not shown that American vegetables can be grown for profit. First, it requires about four times as much work to keep the garden clear of grass and weeds as it does in the States, and even if we did not have so much grass, the land here has to be constantly stirred to keep out white ants; second, the plants, most of them, do not bear as well, and the bugs and worms kill a great many plants and cut off much of the fruit; third, all small garden seeds have to be planted in boxes and raised upon tables to keep the red ants from taking them off. The plants grown in this way have to be all transplanted by hand, and this is tedious and expensive.

After the alfalfa is well established and is cut the first time, I fully believe it can be put on a paying basis and supply a good deal of forage that now is very scarce and very expensive in the province. I think four crops can be raised a year on all the lowland around Batangas, as the water level is only from 6 to 12 feet below the surface.

I recommend that the station be continued here five years, the period for which it was leased, as the present buildings will last about that length of time. At the end of that period, if it is satisfactory, the work could be continued, and more substantial buildings could be erected. There will be needed here at the end of the rainy season two large tanks, of about 12,000 gallons capacity each, to flood the alfalfa fields once a week. These reservoirs or tanks can be built on some high spot that is available, and can be made large and shallow of adobe stone and cement at a very small cost. I also recommend that one native bull be purchased and added to the stock on the farm, this bull to be used in a cart needed on the farm and for cultivating the garden, for, while the mules make a good team, they are too fast for single and neat work in the garden.

The work here is now fairly under way, and another year we will be able to give fuller results and determine more about the future of American plants in this province.

Very respectfully,

Prof. F. LAMSON-SCRIBNER,
Chief Bureau of Agriculture, Manila.

JAMES H. SHIPLEY, *Superintendent.*

EXHIBIT I.

REPORT ON AGRICULTURAL EXPERIMENTS IN BENGUET PROVINCE.

BAGUIO, *August 31, 1903.*

SIR: In compliance with your letter of instructions dated July 13, 1903, I beg to submit herewith the following report on agricultural experiments made at Baguio, Benguet Province, for the year ending August 31, 1903:

On November 14, 1902, I received from you the following letter:

"By direction of the Secretary of the Interior, under date of November 13, 1902, you are hereby authorized to proceed from Manila, P. I., to Baguio and Trinidad, in the province of Benguet, for the purpose of continuing your studies of the agricultural conditions there, locating suitable land and outlining plans for the establishing of an agricultural experiment station, said station to be located as near as possible to the sanitarium consistent with the best interests of the work in view.

"You will also consider and study the situation with a view to establish at or near Baguio or Trinidad, and preferably in connection with the experiment station, a botanical garden. In selecting this location you will consult with the consulting engineer, whom you will find at Baguio, and make a full report upon the situation, cost, and facilities of transportation of agricultural tools and other implements, the site and probable cost of a house for the director or manager of the station and gardens, facilities for securing laborers and wages of same, the housing and maintenance of laborers, stock, tools, seeds, and other items which will be required.

"You are authorized to employ an interpreter when necessary, and employ all necessary unskilled labor, total expenditures therefor not to exceed \$50 per month in money of the United States.

"The following experiment you may begin at once, after securing suitable land: Select a limited number of standard varieties of garden seeds and plant the same at once; in thirty days make a similar planting of the same varieties under as nearly the same conditions as possible. At the end of another thirty days again repeat the plantings, and so continue throughout the year.

"Upon your arrival at Baguio you will report at once by letter what accommodations can be secured for the temporary location of an agent of this bureau, together with the necessary expert laborers and teamsters who may be engaged to assist in carrying out the work contemplated.

"You may take with you a large assortment of seeds in ample quantity for the governor and doctor in charge of the sanitarium and for such other uses as you may deem desirable. You will, of course, afford the governor and Doctor Thomas all necessary information and instructions and such assistance as may be for the proper handling of the seeds."

Acting under this authorization, I proceeded to Baguio, Benguet, where I arrived December 4, being much delayed on the way from lack of transportation. I had a great deal of trouble at first in securing laborers, causing further delay.

There are two classes of labor in Baguio—the Igorrote and Ilocano. The former rarely comes to work voluntarily, and it is only through the courtesy of the governor, who uses a certain authority vested in him, that this class is obtainable. The Ilocano, coming from the plains, wants double the amount of wages as the Igorrote, but is not as good a workman. He remains, as a rule, only a short time here, because he is obliged to go to his place of abode for food, perhaps 30 to 40 miles away, and does not always return. At this time the governor was in Manila, and I could not apply to him for Igorrotes. The Ilocanos were employed on the buildings, and Mr. Rowell, the architect, will certify that he could not get a sufficient number of them.

Much time has been spent in improving the grounds around the sanitarium. In the erection of the building on the steep hillside where it is located the excavation of a great deal of soil was necessary. This was piled up, forming a huge ridge around the building. All this had to be moved away in grading the grounds and establishing suitable approaches to the hospital. This work involved a good deal of time and labor, and necessarily delayed the experimental plantings.

As my connection with experimental work in Baguio along agricultural lines extended over a period of only a couple of months, I could not in this short time come to any definite conclusion regarding the productive capabilities of the soil and climate.

From the knowledge gained by the experiments carried out during the months of March and April, it would seem that Baguio is illy adapted to the growth of many garden crops.

The following is a list of seeds planted at Baguio during the month of March, 1903:

Red Rust Proof oats.	Peas:
White oats.	Burpee's Best.
Kaffir corn.	Alaska.
Alfalfa.	Boston Bush Marrow.
Egyptian corn.	Bliss's Everlasting.
Japan clover.	Bush squash.
<i>Astragalus sinensis</i> .	Leek.
Buckwheat.	Pumpkin.
Caraway.	Beet, Eclipse.
Hops.	Lettuce, Tennis Ball.
Clover.	Flat Dutch turnip.
Cucumber:	Onion, Australian Brown.
Everbearing.	Cabbage, Burpee's Surehead.
White Spine.	Rhubarb, Prince Albert.
Pickling.	Asparagus, white.
Potatoes.	Squash, Boston.

Squash, White Bush.
Celery, White Plume.
Cauliflower.
Egyptian clover.
Cowpeas.
Sulla.
Lima beans.
Red Valentine bean.
Refuge bean.
Sweet corn.
Dreer's cush lima bean.

Teosinte.
Watermelon:
 White Icing.
 Cuban Queen.
Muskmelon:
 Rockyford.
 Paul Rose.
Vegetable marrow.
Pear millet.
Velvet bean.
Indian corn (native).

The seeds sown germinated successfully, and the first stage of growth gave promise of an abundant return; but in a short time, when the plants had to depend altogether upon the elements absorbed from the soil, they became sickly and some of the varieties died.

RECORD OF SOME OF THE SEEDS PLANTED.

Peas.—"Alaska." Sown March 12; germinated March 20; strong, even growth, a couple of inches high; promising; the most satisfactory of the varieties sown so far; April 5, 3 to 4 inches high; growth slender and weak; plants yellowish. "Strategem". Sown March 12; germinated March 25; even germination; strong; healthy; April 5, prostrate sturdy growth; good color. "Burpee's Best." Sown March 12; germinated March 27; just over ground; too early to show any peculiarity of growth; April 5, slender growth; becoming yellowish and unhealthy.

Radish.—Sown March 12; germinated March 22; since germination growth not satisfactory; April 5, very little growth; turning yellow.

Brussels sprouts.—Sown March 12; germinated March 22; growth uneven; April 5, seed leaves turning yellow; nearly all the plants dying.

Cabbage.—"Early Winningstead." Sown March 12; germinated March 27; growth uneven; April 5, little growth, many plants turning yellow and a number dying.

Kale.—"Henderson's." Sown March 12; germinated March 27; a very uniform germination; April 5, very little growth; the third leaf developing; a few of the plants turning yellow.

Eggplant.—"New York." Sown March 12; germinated March 27; in comparison with the others, a quick germination; April 5, continues in strong seed leaf.

Lettuce.—"Deacon." Sown March 12; germinated March 29; April 5, not growing, most of the plants in seed leaf.

Corn.—"Crosby's." Sown March 12; germinated March 27; April 5, three leaves developed, the tips withered, roots apparently healthy.

Beans.—"Dwarf Wax." Sown March 12; germinated March 25; April 5, two leaves developed; hard and yellowish. "Red Valentine." Sown March 12; germinated March 29; April 5, two leaves developed; plants, yellowish and unhealthy. "Early Refuge." Sown March 12; germinated March 29; April 5, leaves hard, yellowish, and wrinkled. "Lima," planted in hills. Sown March 12; germinated March 27; April 5, wrinkled, unhealthy, leaves yellow.

Sweet corn.—"Country Gentleman." Sown March 12; a few now germinating; April 5, three leaves developed; the tips withered; roots apparently healthy.

Endive.—"White Curled." Sown March 12; germinated March 20; since then has made no growth; April 5, no growth, plants dying.

Oats.—"Red Rust Proof." Sown March 16; germinated March 27; only about one-fifth of the seeds sown have germinated; April 5, tips of leaves withered, fairly healthy.

Astragalus from Japan. Sown March 16; germinated March 25; every seed of this forage plant seems to have germinated; April 5, not making any growth.

The experience gained in the cultivation of crops in various soils and climates elsewhere, when applied to Baguio, does not count for much, because we have here altogether different conditions to contend with and, until by experiment we shall have found out what these conditions are, we can not expect to overcome the difficulties.

The failure to grow garden crops would indicate a lack of judgment in selecting them for cultivation. It can not be said, however, that there is the slightest indication of those qualities that denote an unproductive soil. Its surface is covered with a dense growth of grasses, chiefly bromes and panicums. Coffee, when cared for, does remarkably well. Potatoes give good results, and the gourd family does very well. Physically considered, the soil seems to be above the average. It is easily worked, has good drainage, and does not bake under cultivation, making it all the more puzzling to account for its inability to grow the common garden vegetables.

The seeds sown germinated fairly well, showing no sign of the fate that subsequently overtook them. In nearly all cases there was but little growth after the seed leaves developed. They soon assumed a sickly yellowish color, followed by the death of almost every kind sown. The starting of the disease, if we may so call it, coincides with the time when the young plants, having exhausted the stored-up nourishment of the seed itself, became dependent upon the food elements in the soil. This experience is but a repetition of that of July of last year (1902). The general opinion of those who have tried American vegetables here is that the climate is too cold and the soil is not good. It may be that there are elements in the soil unfavorable or poisonous to plant growth. Especially might this be true in the case of the valley lands. The Igorrotes invariably select the steep hillsides for cropping. It is possible that these hillside lands are superior to those in the valleys, for the reason that the poisonous elements have been leached out by the heavy rains. Both lowlands and hillsides are covered with a dense and luxurious growth of grasses, chiefly bromes and panicums.

By May 2 it was evident that everything, with the exception of melons and squashes, was a failure. Repeated sowings of many varieties of garden seeds in thoroughly cultivated soil have all been unsuccessful. The apparently excellent black soil of the hillside plot was disappointing, beans, pease, etc., showing the same characteristics as marked the failures in the valley land. Squashes and pumpkins grew very well in the red subsoil that formed the surface of one of the terraces after the black soil was removed in grading. Cowpeas, soy beans, and oats came up but sparingly, and the vetches made only a spindling growth. The alfalfa did not advance beyond the seed leaf.

The results in growth upon the same soil are often of such a contradictory character that deductions based upon such experiments would be apt to show a good deal of inconsistency. For example, cabbage plants from seed die at an early age, giving ground for the belief that this crop is a failure; but, on the other hand, sprouts stuck in the ground grew into large heads, giving the idea that the soil is admirably adapted for this plant. Again, as before described, the first stage of growth is very promising, but the succeeding growth is disappointing. In July of last year I expressed a favorable opinion about the outcome, based upon what I saw of this early promise. In April of this year I expressed an unfavorable opinion of the productive powers of the soil, basing my opinion upon the later stages of growth. This fact will explain the reason of these widely different statements.

Broadly speaking, I would say that the soil may contain mineral ingredients that are injurious to cultivated plants. The soil may also be deficient in nitrogen. The decay of vegetable matter, by cultivation and application of manure, would supply any deficiency in nitrogen, while the leaching of the cultivated ground by rains would probably wash away the soluble mineral elements of an injurious character. How far the climatic conditions affect growth can only be discovered by a larger series of experiments.

With regard to the growth of American fruits in Baguio, I stated on a former occasion that I thought they could not ripen their fruits in the rainy season, which seemed to me the time for these fruits to mature. Further observations would tend to modify this statement. A couple of small peach trees, which were leafless in the early part of the year, suddenly burst into leaf in June and, assuming that this period could be looked upon as the beginning of the growing season of deciduous fruit, the time of ripening of the fruit could be looked upon as about November, a month of sunshine. It will, of course, require a much more extended study of the subject before a conclusive opinion can be formed about the matter.

With regard to suggestions for future work, I would advise the taking up of systematic experimental work in Baguio with the view of finding out the true conditions of soil and climate. I have a strong hope that the injurious conditions will yield to skillful treatment, which would be the outcome of such experiments. The benefit to be derived would be almost incalculable.

Probably there is no spot in American territory to-day that would seem to have the same advantage in the way of climate for 10 months in the year as Baguio. The only disadvantage the place possesses is that so far the soil has not yielded a remunerative return, and it would reflect no small credit upon the bureau of agriculture if it could discover a means for overcoming the injurious conditions that now prevail in the way of cultivation.

I would be glad if I could go into this matter, but the work mapped out for me will take up every moment of my time. It is not alone the fixing up of grounds around the sanitarium that claims attention, but the beautifying of the grounds around all the other buildings has also to be taken in hand, and this, together with the station at Trinidad, leaves no time for systematic experimental work.

With regard to the prospects at Trinidad, $4\frac{1}{2}$ miles distant from Baguio and 500 feet lower in elevation, there is luckily no question regarding the outcome, as nearly all American vegetables grow well in the valley; but to obtain the best return we must adopt modern methods of cultivation instead of the primitive system of turning over the ground with sticks.

Taking into account that the military authorities are erecting barracks in Baguio, and that many public buildings will soon be added, I would say that next season, on account of the influx of population, there will be a good demand for farm produce, and that farming on an extended scale in Trinidad with modern methods would prove a profitable undertaking.

Respectfully,

THOMAS HANLEY,
Expert in Tropical Agriculture.

Professor LAMSON-Scribner,
Chief Bureau of Agriculture, Manila.

EXHIBIT J.

**REPORT OF THE DIRECTOR OF THE COLLEGE OF AGRICULTURE AND EXPERIMENT
STATION AT LA GRANJA MODELO, LA CARLOTA, P. I.**

LA CARLOTA, August 31, 1903.

SIR: The organic act creating the College of Agriculture (act No. 512) was passed November 10, 1902. A director was appointed March 25, 1903, and work was begun at the experiment station, known as "La Granja Modelo," on April 22, 1903.

This is a beautiful tract of land, 780 hectares in extent, bounded on the north, south, and southeast by small streams or creeks. The surface is very much broken by gullies and washes on the south and southeast half. The soil on the north half is extremely loose alluvium mixed with a great deal of sand. The depth of the soil on this, the north side, varies from 14 inches to 4 feet, over a subsoil of gravel conglomerate or yellow clay. The soil is so diversified that it will require much time before an accurate physical survey can be made.

The soil of the south half is extremely clayey, capped with arable soil of rich black alluvium to a depth varying from 6 inches to 4 feet. There is very little rock subsoil near the surface of this tract, although it is found in some of the deep washes. The south half is very much broken, there being few tracts of level land of an area greater than 40 acres. The slopes and bottoms are rich and fertile and well suited for the cultivation of hemp, coffee, cacao, etc.

The place was found to be in woeful condition. The sugar mill was in a state of collapse, the roof falling in and supports all rotting. All the buildings on the place built under Spanish rule (sugar mill and one corrugated-iron warehouse excepted) had been burned in 1899. Since then some eighty-odd nipa or grass huts of the worst sort of construction have been built and occupied by natives. These huts were in the worst state of repair; some so filthy that I ordered them burned.

There was one house habitable. This was built by the United States military forces subsequent to the Spanish evacuation. All property saved from the insurgents had been given over to Señor Juan Araneta to care for. I use the expression "saved from the insurgents" advisedly, for, from information, I am led to believe that most of the property of any value to the natives, such as hoes, spades, carpenters' and blacksmiths' tools, etc., was taken by the insurgents when they made their raid in this section. I have traced some of the articles, and have made official requests to the presidents of the municipalities where located to have same returned. Señor Araneta has a quantity of articles in his charge, most of which are of little value. I have no place to store them at the college, so leave them with him until such time as buildings may be available. Some of the articles held by Señor Araneta will be of value when laboratories are built. The only inventory ever received by this office from Señor Juan Araneta is herewith attached. The books are out of date, most of them printed in the sixties or seventies. Some date from 1812, but few are of any practical value. Everything in the shape of tools, machinery, vehicles, etc., was taken at the evacuation, and nothing remains but some scrap iron, which the insurgents attempted to destroy by fire, and the heavy cast-iron parts of the sugar mill, which could not be carried away.

I found that out of a herd of 70 there were but 6 carabaos left, and out of over 30 wagons or carts but 6 were in such condition as to be temporarily serviceable. Out of a mass of old iron and broken wheels Foreman Heil and native carpenters managed to patch up four more carts, which can be used in an emergency.

There were no crops of much value on the place when I arrived. A grass fire had destroyed all the standing hemp (there was very little to destroy), and also almost the entire crop of "bongoes" (betel nuts). On the south and southwest part of the La Granja there are about 40 acres of land cleared and partially planted by natives, in corn, camotes, rice, etc. They claimed to have had a contract with Señor Araneta, under which they were to give him one-third of the crop. As I have no present need for said land, and being Señor Araneta's successor, I leave things in statu quo. Returns for sale of government's share of such crops will be found in my monthly returns.

The natives living on the place are of two kinds—i. e., one element, the old employees under Spanish rule, the other, an aggregation of the starving mountaineers or discharged laborers from other haciendas. I have disturbed no one thus far who works well. The moment these undesirable people make themselves objectionable, I have them put off the place, family and all. In this way the bad element is being weeded out and their places filled with the best in the neighborhood, at the same time not giving the natives cause for a general complaint.

Upon my arrival there was but one habitable house on the place. This house of one room was used for office, kitchen, sleeping room, etc., until shacks were built for foreman and teamster. The one serviceable camarine was repaired and cleaned out. The roof of the sugar mill was made so as to shed water and serve as shelter for the expected live stock and the pillars cut off or replaced.

About 25 or 30 acres have been cleared of brush and weeds, so as to enable the six carabaos to be used in roughly plowing the same with the plows that Foreman Heil was enabled to patch up.

Seeds received from the bureau of agriculture were at once planted, and proper reports will be made as soon as there are any results. The abandoned abaca (hemp) field is being transplanted to what is believed to be suitable soil on the south side. The forest of tropical growth found in the coffee and cacao plats have been cleared, almost all the coffee and cacao plants were destroyed by fire.

The roads on the La Granja were in the worst possible condition. Over 2 miles of public roads on this place were nothing less than drainage ditches, in many cases 4 feet below the level of the adjacent land, and almost impassable for carabao carts. By borrowing and making in the blacksmith shop hoes and spades, I have now 2 miles of the finest "dirt road" in the province. An irrigation canal had made the road impassable, so a fine concrete bridge has been made with native labor. This was an absolute necessity.

The road work done at La Granja was the means of my being able to organize a "good roads" association and, with the help of the supervisor of the province, Mr. Fauntleroy, I have been able to repair the road between La Granja and La Carlota, a distance of 6 miles, the neighboring hacendados contributing the greater part of the expenses. I had to advance the money for the first three weeks' work out of personal funds, but the work is done, and well done, so far as mere repairing is concerned. With but \$500 Mexican I could not make a road out of hand from La Granja to San Enrique, a distance of 20 miles. However, a carabao cart can now pass during the rainy season when it could not do so before. The provincial supervisor promises aid for the coming year, so that I hope that the most important factor in prosperous agriculture, i. e., "good roads," will be a reality and not a theory before the end of the coming year.

Authority to sell the antiquated sugar mill has been requested for the reason that it is deemed that any attempt to raise sugar cane under the existing circumstances would not only be unremunerative, but would also bring the experimental work into disrepute with the neighboring sugar planters, who are better equipped with men, mills, and machinery, and live stock. I hold it to be self-evident that all experimental work attempted at an experiment station should demonstrate something of value to the agricultural community. This being granted, I deem that any attempt to use the present sugar mill and equipment would simply prove that the neighboring plantations could do better work than the experiment station. This province being almost entirely devoted to sugar making, I deem that a very considerable part of the efforts of this station should be devoted to the sugar interests. The very heavy expense of installing a modern sugar mill precludes, for the present, all idea of making sugar at this station. There is, however, a very important work to be done in order to aid the sugar growers—i. e., the introduction of new varieties of cane from Java, Sumatra, Hawaii, Cuba, etc., and demonstrating their superiority over the varieties now grown in this archipelago. To this end application has been made to the division of seed introduction of the bureau of agriculture for as much of the new cane as can be had. These new varieties will be grown on the La Granja and disposed of to the neighboring planters when their qualities have been demonstrated. In this connection one of the chief objects of the director is to demonstrate the economy of the

use of mules and draft animals over carabaos. In order to do this a cheap forage plant must be found. To this end the division of seed and plant introduction of the bureau of agriculture has been called on, and it is believed that one or two forage plants well adapted to this climate have been found. Experiments have been already undertaken and reports will be made when there is anything definite to report. Teosinte, alfalfa, millets, etc., have been asked for. Same have been received and have been planted.

The greatest need of the experiment station is a sufficient number of draft animals, harnesses, and American farm hands. Up to date not one serviceable animal or a single set of work harness has been received at the station. All work done thus far has been by means of the six carabaos found on the place. Excepting the clearing of brush, the planting of a few small patches of vegetables, forage plants, etc., and the cutting of timber and bamboos, all work at the experiment station is at a standstill, owing to the fact that suitable draft animals are not available.

The land in this province being especially well adapted for the use of steam plows, and the present carabao methods of cultivation being notoriously inadequate, I urge that this station be equipped with a modern, up-to-date steam plow, not only as a measure of economy in cultivating the government land, but as one of the most useful object lessons possible to the agriculturists of this archipelago, and of this province especially.

THE COLLEGE.

The act creating the college of agriculture contemplates the founding of a school of agriculture. The site selected is on the old Spanish agricultural station, known as "La Granja Modelo." This is 6 miles east of La Carlota, at the foot of the range of mountains which divides the island of Negros into two almost equal parts. It is nearly 20 miles from the coast, from which the vast sugar producing plain slopes gently, till at La Granja the altitude is 780 feet. The climate is one of the most healthy on the island, the only diseases being those epidemics not in any way climatic. The usual amount of malaria, generally noted where no mosquito nets are used, is of course to be expected.

The site selected for the college buildings is one of great beauty, on a gentle slope, affording excellent drainage. The fall for the water supply is ample to carry it to the third story of any building. Three hundred yards behind the college site is a small hill, on which is the old ruined observatory, alongside of which the former director had a fine residence, which was burned by the "monteses." One hundred yards east of the observatory is the partially destroyed camarine. This is situated in a finely drained and well protected depression. Here the Spaniards had their stables, etc., and it is intended that the stables to be erected under the present régime will be on the site of the former ones.

The site having been selected, and the preliminary work done, so far as lies in the province of this office, action by the proper authorities concerning buildings must be awaited before any steps can be taken with regard to the plans for construction.

The following suggestions to those in charge of construction are respectfully offered:

First. Owing to the difficulty of procuring resistant timbers, and the very great expense of transporting the same to such an isolated place, over the worst sort of roads, I recommend that the main building for students' dormitories, laboratories, class rooms, etc., be constructed of brick. The bricks can be made within 700 yards of the college building site. A sample of brick made on the place has already been forwarded to your office.

Second. I would further recommend that the crossbeams be of iron. I make this recommendation after five years' observation in the Philippines of the action of rots and insects on timber. From observation and information gathered in this province, I am led to believe that no structure could be made to last for more than a limited number of years if local timber be used. Hence, the only timber that would be more or less permanent must be brought from a great distance. The expense of the iron beams, which would be permanent, will be very little more than seasoned superior group timber brought from Manila or Mindanao. The La Carlota Tramway Company can land the iron at La Carlota, and I will have the road in good condition by the time it reaches La Carlota.

Third. The first floor "entre sol" for laboratories, etc., should be of cement, in order to keep ants from breeding under the building. The second floor should be of "molave," or its equivalent. The roof should be double (boards and corrugated iron), with air space of at least 2 feet between the nipa and board part on top.

Fourth. The houses for the college staff should be built of boards, with floors at least 8 feet above the ground, and double roof, although a good nipa house, with board floor and bamboo walls, is as healthful and fully as comfortable, besides being far less expensive.

In every case the houses of the employees should have a 10 or 12 foot piazza on all sides. This is necessary to keep out the rain during the many driving storms, as well as the radiated heat. Without nipa piazzas as sunshades no office work is possible during the heat of the day.

Fifth. The stables and outbuildings (except storerooms for tools, etc.), should be of nipa, bamboo, and such solid arrigues as are necessary to insure sufficient rigidity.

From observation and information, I am fully persuaded that there will be no lack of students, if a good corps of instructors and suitable buildings are furnished. I have already had many inquiries from parents concerning the courses of instruction to be offered, and I am assured that there will be no lack of students from this province alone.

The courses of instruction are, by law, to be determined by the chief of the bureau of agriculture. The director respectfully suggests that the college should be modeled on some such plan as that of *P'Ecole Nationale d'Agriculture de Montpellier*, giving a due amount of practical work merely as illustration; not as a means of saving money, as is done in many institutions. The work on the experiment station should be done by hired help. Few students could be had if too much manual labor were required of them. Act 649 should be amended so as to enable the director (in case of emergency, harvesting, etc.) to employ the necessary number of laborers. The legal number of native laborers is 75. Most of the time this number will be sufficient for carrying on the work of the experiment station but occasionally emergencies arise which require a greater number. In order to avoid undue complications in the disbursing officer's accounts, I suggest that the act be so amended as to produce the least possible friction and delay.

The director respectfully calls attention to the mail and telegraph service at this isolated post. At present it is impossible for this office to keep the necessary paper work up to the dates prescribed by the head office. As an illustration of the isolation of this station I would call attention to the fact that there are but two telegraph offices in this province—one at Bacolod and one at La Castellana. Bacolod is an eight-hour ride in good weather from La Granja, and La Castellana is over two and one-half hours distant.

The mail from Manila reaches Iloilo each Monday at 6 a. m. The director has frequently left La Granja at 6 a. m. Monday, spent Tuesday in Iloilo, and left Wednesday at 8 a. m., reaching Pulupandan with the mail bag at noon, and the college of agriculture (6 miles beyond the post-office at La Carlota) at 7 p. m. The mail bag, however, does not reach La Carlota until Thursday night at 8 o'clock, or Friday night—generally the latter. It is therefore impossible for this office to keep up with the regular routine business, as per general orders from headquarters. The telegraph line from Dumaguete, La Castellana, Bacolod, Iloilo, and Manila now passes through La Carlota, the center of the richest province in the archipelago, yet there is no telegraph office nearer than La Castellana. The opening of an office at La Carlota would prove of very great financial benefit to the sugar planters of this region, and is urged by all the population from San Juan de Ilog, San Enrique, Valladolid, Baguio, etc.

The roads are in such wretched condition that all commerce between neighboring towns is paralyzed, and the profits from sugar raising has dropped from a fair sum under Spanish rule to a pittance or changed to an actual loss at present. Governmental aid should be had if possible; for the hacenderos are too poor to make roads without help.

Operations dating from April 22 and ending June 30, which embraces all the period covered by this report, have been as successful as the circumstances have permitted; in fact, more has been done than the circumstances warranted.

Requisitions for material were signed by the chief of the bureau in March, 1903, and I have to thank the central bureau for its energetic aid, where possible.

Until draft animals and American farm hands are received the work on the experiment station will be insignificant, being merely a sort of hand-to-mouth patchwork cultivation to save government property and get along the best we may.

RECEIPTS.

April, treasurer's warrant No. 3122	\$2, 550. 00
June, treasurer's warrant No. 3337	5, 083. 75
	<hr/>
	7, 633. 75
	<hr/>

DISBURSEMENTS.

April:		
Salaries and wages	\$702. 84	
Contingent expenses	39. 00	
	<hr/>	\$741. 84
May:		
Salaries and wages	1, 222. 69	
Contingent expenses	198. 15	
	<hr/>	1, 420. 84
June:		
Salaries and wages	1, 451. 26	
Contingent expenses	494. 80	
	<hr/>	1, 946. 06
Balance due government June 30, 1903		3, 525. 01
		<hr/>
		7, 633. 75

Buildings and articles found on place on April 22, 1903.—One observatory, 31 feet by 30 feet 6 inches by 27 feet 6 inches; 1 camarine, brick (burnt), 66 by 26 feet; 1 corrugated-iron camarine, 53 feet 6 inches by 27 feet 9 inches; 1 dwelling house, 40 by 20 feet; 1 mill, sugar, 99 feet by 67 feet 6 inches.

Contents of mill.—One cane press, feed 2 feet 7 inches, diameter of rollers, 1 foot 8 inches; 6 boiling caldrons, 5 feet 6 inches diameter, 2 feet deep; 2 boiling caldrons, 4 feet 6 inches diameter, 1 foot 6 inches deep; 4 boiling caldrons, 6 feet diameter, 2 feet 3 inches deep; 2 tanks, boiler iron, 7 feet 4 inches diameter, 2 feet deep.

Tools, animals, machinery, etc.—Six carabaos; 6 carts (poor condition); 1 plow, 7 inch (poor condition); 1 plow, road (poor condition); 1 hay rake (poor condition); 2 clod breakers, roller (poor condition); 1 rice huller, hand (poor condition).

There are a great many pieces of machinery that can be utilized later on in patching up farm implements. None of these can be used at present, and will only be taken up on property return when put together. Until taken up on property return these articles will be classed as "scrap iron."

Respectfully,

A. P. HAYNE, *Director.*

Prof. F. LAMSON-SCRIBNER,
Chief Bureau of Agriculture, Manila.

EXHIBIT K.

REPORT OF THE DIRECTOR OF ANIMAL INDUSTRY.

MANILA, August 31, 1903.

SIR: I have the honor to present herewith, in compliance with your verbal request, the following report:

I received the appointment to the position of director of animal industry February 13, 1903, assuming charge March 27, 1903.

The work of organization has been seriously impeded by the several calls for my services from the board of health and bureau of government laboratories for assistance in the work of immunizing animals in the provinces of Pampanga, Zamboanga, and Tarlac.

The ravages of infectious and contagious diseases during recent years among the animals of the Archipelago have been attended by a most appalling mortality.

Rinderpest, surra, glanders, and other maladies have claimed such a large number of animals that stock owners have become impoverished and much valuable land remains untilled, owing to the resulting paucity of draft animals. That the raising of live stock in the islands can be made a lucrative business or a profitable adjunct to general agriculture is indisputable.

At the present time two important factors must, however, be considered when engaging in the rearing of live stock. Greater care must be employed in the preven-

tion of contagious diseases, and more attention must be directed to the cultivation of forage crops to supply the deficiency usually experienced during the dry season.

There is certainly a demand for beef and working animals in the Archipelago, judging from the prices they command in the city of Manila. Good native ponies find ready sale at from \$50 to \$250 United States currency, and exceptionally choice animals, possessed of size, conformation, speed, and substance, frequently change hands at \$1,000 United States currency each.

The cattle sold in Manila for beef purposes are mostly imported from Shanghai, Singapore, and a few from Java. Those from Shanghai bring from \$75 to \$85 Mexican at the matadero. Those from Singapore are usually younger, smaller, and more desirable for beef, but weigh less, and bring from \$60 to \$65 Mexican per head.

Between four and five thousand cattle are slaughtered monthly at the abattoir in Manila, and the demand for fresh meat will assuredly increase, as will also that for fresh milk.

At the present time the latter commodity commands such an exorbitant price that a demand certainly exists for good dairies in the vicinity of Manila, with sanitary supervision of the animals and premises and the care and delivery of the product.

About 1,000 hogs are converted into pork every month at the abattoir. The majority of these animals are brought from Shanghai, and bring from 35 to 40 cents Mexican per pound when dressed. Singularly enough, this class of animals in the islands are more free from liability to contagious diseases than would be expected, although hog cholera appears at frequent intervals, but the disease proves amenable to prophylactic measures.

Working carabaos are worth from \$35 to \$75 United States currency, according to age, size, and sex, the present scarcity being occasioned by the frequent outbreaks of rinderpest.

With the large amount of grazing lands in the Archipelago and the adaptability of the soil to the growing of forage plants, there is no apparent reason why stock should not flourish, aided by our increasing knowledge of the prophylaxis of infectious diseases. The stock found at present in the islands is, generally speaking, of an inferior quality, owing to various causes. Paramount among these are injudicious and careless breeding, lack of care during development, and inattention to feeding problems.

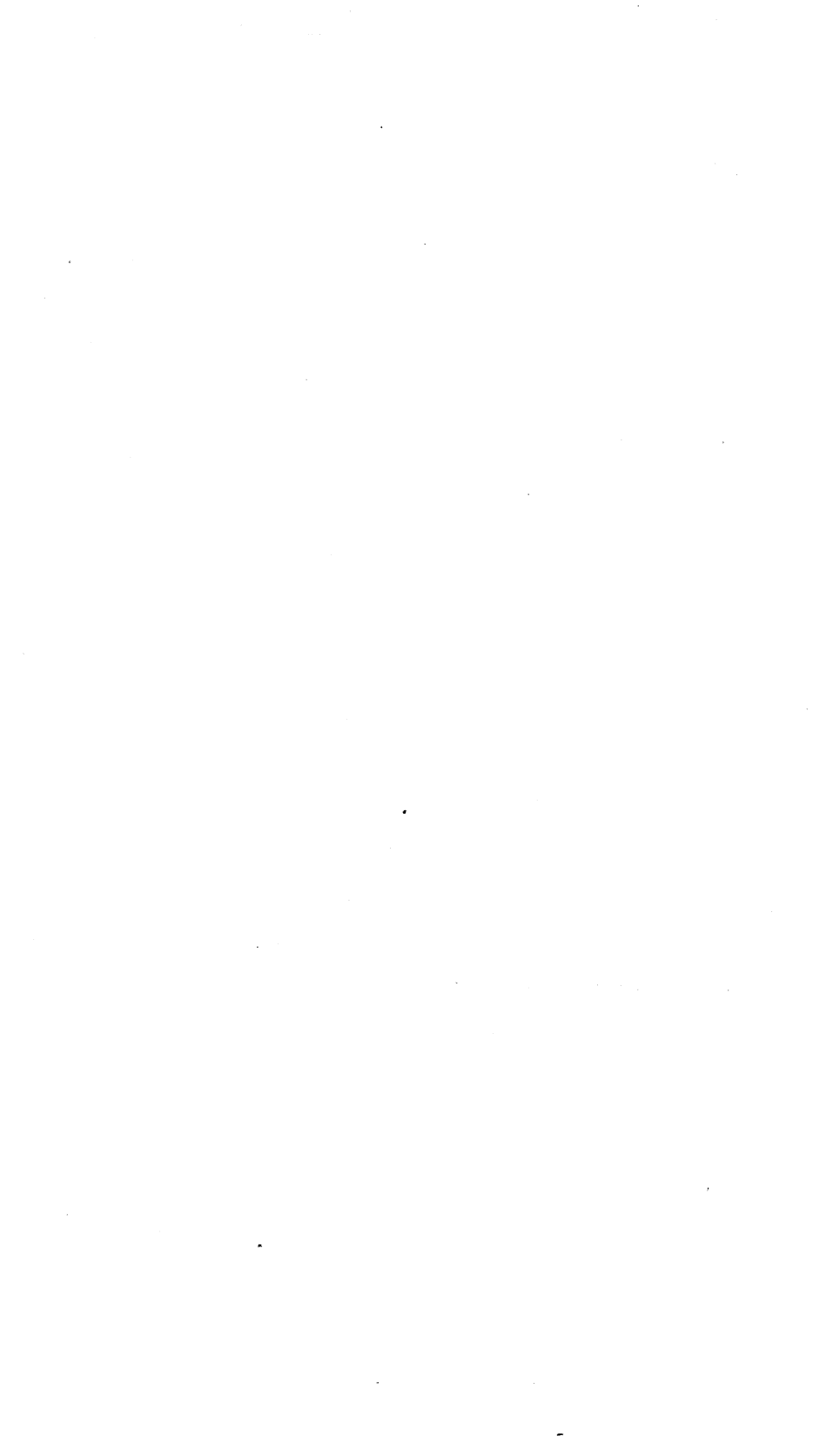
To successfully cope with this matter, new blood must be introduced and a system of selection in breeding be adopted. The castration of inferior males and those which do not approximate certain standards of excellence will, to a great extent, assist in the desired improvement of the native animals.

It will be the especial province of this division of the bureau to aid in the introduction of new breeds of animals for breeding purposes, to experiment with different breeds and crosses, with a view to ascertaining those best adapted to existing conditions in the islands, and to prepare and issue periodically bulletins relating to this work.

Respectfully,

HARRY H. DELL,
Director of Animal Industry.

Prof. F. LAMSON-Scribner,
Chief Bureau of Agriculture, Manila.



APPENDIX J.

REPORT OF THE DIRECTOR OF PHILIPPINE WEATHER BUREAU FOR THE YEAR ENDING AUGUST 31, 1903.

PHILIPPINE WEATHER BUREAU,
Manila Observatory, September 15, 1903.

SIR: In compliance with your request, I have the honor to submit the following statement about the work done in this bureau from the time of my last report to August 31, 1903.

It is a pleasure to me to begin with a letter from the Chief of the United States Weather Bureau concerning my last report:

UNITED STATES DEPARTMENT OF AGRICULTURE,
WEATHER BUREAU,
Washington, D. C., July 15, 1903.

DEAR COLLEAGUE: I have to thank you for a copy of your report of September 15, 1902, as contained in the report of the Philippine Commission, and must congratulate you on the energy and success with which you have prosecuted your great work. By extending your service over all the islands of your Archipelago and by collecting daily telegrams from fifty stations or more, between the sixth and twentieth degrees of latitude, you have certainly rendered it possible to forewarn both your own stations and those of neighboring countries of the approach of typhoons and other weather changes. I am pleased to perceive that by our own cooperation we have been, as you state, useful to you in perfecting your outfit.

If agreeable to you I will suggest to the international meteorological committee that your name be added to it. Would reporting stations at Guam and Midway be of special advantage to you?

Wishing you a continued success, I remain,

Very respectfully,

WILLIS L. MOORE,
Chief United States Weather Bureau.

Rev. JOSÉ ALGUE,
Director Philippine Weather Bureau, Manila, P. I.

The present report embraces the following items:

A. An account of the erection of new stations and inspection of those already erected.

B. New instruments in the central observatory and branch stations.

C. Telegraphic service and work in branch stations.

D. Earthquake records.

E. Crop service.

F. Typhoon signals.

G. Publications of the bureau.

H. Work of the mechanics.

I. Work in the astronomical department.

J. Work in the magnetic department.

A. ERECTION AND INSPECTION OF STATIONS.

List of stations in working order August 31, 1903.

Station.	Province.	Geographical coordinates.		Class.	Telegraphic report every day to the Manila central.
		Lat. N.	Long. E.		
		° /	° /		
Aparri.....	Cagayan, Luzon.....	18 21	121 35	First.....	6 a. m., 10 a. m., 2 p. m.
Dagupan.....	Pangasinan, Luzon.....	16 4	120 16	.....do.....	Do.
Atimonan.....	Tayabas, Luzon.....	13 59	121 53	.....do.....	Do.
Legaspi.....	Albay, Luzon.....	13 9	123 44	.....do.....	Do.
Ormoc.....	Leyte.....	11 1	124 33	.....do.....	Do.
Iloilo.....	Iloilo, Panay.....	10 42	122 34	.....do.....	Do.
Cebu.....	Cebu.....	10 17	123 35	.....do.....	Do.
Santo Domingo.....	Batanes.....	20 25	121 58	Second.....	
Vigan.....	Ilocos Sur, Luzon.....	17 33	120 24	.....do.....	Do.
Cabo Bolinao.....	Zambales, Luzon.....	16 24	119 55	.....do.....	Do.
San Isidro.....	Nueva Ecija, Luzon.....	15 18	120 52	.....do.....	Do.
Olongapo.....	Zambales, Luzon.....	14 50	120 16	.....do.....	Do.
Daet.....	Camarines, Luzon.....	14 5	122 57	.....do.....	
Capiz.....	Capiz, Panay.....	11 34	122 45	.....do.....	Do.
Tacloban.....	Leyte.....	11 15	124 59	.....do.....	Do.
Maasin.....	.....do.....	10 8	124 45	.....do.....	Do.
Surigao.....	Surigao, Mindanao.....	9 45	125 31	.....do.....	Do.
Tagbilaran.....	Bohol.....	9 38	123 50	.....do.....	Do.
Candon.....	Ilocos Sur, Luzon.....	17 22	120 27	Third.....	6 a. m., 2 p. m.
San Fernando.....	Union, Luzon.....	16 37	120 21	.....do.....	Do.
Baguio.....	Benguet, Luzon.....	16 35	120 43	.....do.....	Do.
Tarlac.....	Tarlac, Luzon.....	15 31	120 35	.....do.....	Do.
Iba.....	Zambales, Luzon.....	15 21	119 57	.....do.....	Do.
Arayat.....	Pampanga, Luzon.....	15 8	120 46	.....do.....	Do.
Corregidor.....	Isla Corregidor.....	14 24	120 38	.....do.....	Do.
Nueva Caceres.....	Camarines, Luzon.....	13 38	123 12	.....do.....	Do.
Calbayog.....	Samar.....	12 7	124 40	.....do.....	Do.
Catbalogan.....	.....do.....	11 46	124 53	.....do.....	Do.
Tuburan.....	Cebu.....	10 48	123 48	.....do.....	Do.
San José de Buenavista.....	Antique, Panay.....	10 44	121 54	.....do.....	Do.
Bacolod.....	Negros Occidental.....	10 40	122 56	.....do.....	Do.
Balingasag.....	Misamis, Mindanao.....	8 48	124 46	.....do.....	
Butuan.....	Surigao, Mindanao.....	8 46	125 35	.....do.....	
Dapitan.....	Misamis, Mindanao.....	8 38	123 24	.....do.....	Do.
Caraga.....	Surigao, Mindanao.....	7 30	126 32	.....do.....	Do.
Cotabato.....	Cotabato, Mindanao.....	7 13	124 12	.....do.....	Do.
Davao.....	Davao, Mindanao.....	6 58	125 35	.....do.....	
Zamboanga.....	Zamboanga, Mindanao.....	6 55	122 2	.....do.....	Do.
Jolo.....	Isla de Jolo.....	6 3	120 59	.....do.....	Do.
Gubat.....	Sorsogon, Luzon.....	13 56	124 7	.....do.....	
Binang.....	Laguna, Luzon.....	14 20	121 6	.....do.....	
Bayombong.....	Nueva Viscaya, Luzon.....	16 28	121 6	Fourth.....	Occasionally
Masinloc.....	Zambales, Luzon.....	15 34	119 56	.....do.....	Do.
Marilao.....	Bulacan, Luzon.....	14 46	120 56	.....do.....	Do.
Balanga.....	Bataan, Luzon.....	14 42	120 32	.....do.....	Do.
Cavite.....	Cavite, Luzon.....	14 29	120 54	.....do.....	Do.
Borongan.....	Samar.....	11 42	125 25	.....do.....	Do.
Cuyo.....	Paragua.....	10 51	121 1	.....do.....	Do.
Loon.....	Bohol.....	9 48	123 47	.....do.....	Do.
Isabela.....	Basilan.....	6 40	121 57	.....do.....	Do.
Indang.....	Cavite, Luzon.....	14 12	120 52	.....do.....	Do.
Baler.....	Principe, Luzon.....	15 47	121 34	.....do.....	Do.
Palanog.....	Masbate.....	12 22	123 37	.....do.....	Do.
Ibaan.....	Batangas, Luzon.....	13 48	121 7	.....do.....	Do.
Guam.....	Marianas or Ladrone Islands.....	13 38	144 45	.....do.....	

Gubat is a very valuable addition to our list, inasmuch as it is expected that very soon it will be telegraphically connected with our central station.

It has been proposed to extend the cable to the small island of San Bernardino, lying at the very entrance of San Bernardino Strait, from the Pacific, and to erect there a station which will be very useful to warn vessels coming from America before entering the Interinsular and China seas.

But the most important addition will be the establishment of a station at Guam, Ladrone or Marianas islands. An account on the steps taken in this matter will be of interest to you.

PHILIPPINE WEATHER BUREAU,
MANILA OBSERVATORY,
Manila, July 2, 1903.

To His Excellency the Civil Governor of the Philippine Islands.

SIR: As pointed out on page 36, Part II, of my report for 1902, meteorological stations at Yap (Western Carolines), Guam, and Ponape (Eastern Carolines) would form a most important extension of the Philippine weather service. Of these places Guam, being now in telegraphic communication with Manila, I respectfully submit to you a plan for establishing such station at Agana, the capital of the island of Guam.

It would suffice to erect a third-class station. I have a young, well-trained observer, who is willing to go to Guam on the salary of a third-class observer.

A set of standard meteorological instruments is already on hand. Hence the expenses would be in no proportion to the great utility of the proposed station.

In case my estimate for appropriations for the fiscal half year, June 30 to December 31, 1903, is approved of as submitted, I am willing to pledge myself that the new station shall not cause any additional expenses to the Government provided the government of the Philippine Islands prevails upon the company controlling the new cable that two meteorological messages per day from Agana to the central observatory and eventual typhoon warnings from this observatory to Agana be transmitted free of charge. The latter is added, because on very rare occasions it might be desirable to inform a United States army transport at Guam of the existence of a typhoon in its way to Manila.

The request to the cable company for free transmission of two daily dispatches is nothing extraordinary, as a similar service, only of much greater extension, is continually being rendered by the other great cable company of the Far East, viz, the Great Northern Telegraph Company and the Eastern Extension Australasia and China Company, as set forth on pages 34 and 35 of the report above cited.

Respectfully, yours,

JOSÉ ALGUÉ,
Chief of Philippine Weather Bureau.

In a conference with the Commission on July 17 it has been resolved by the Commission that a meteorological station at Guam should be established and that necessary steps be taken to that purpose. In compliance with this resolution of the Commission I addressed the following letter to the executive secretary:

PHILIPPINE WEATHER BUREAU, MANILA OBSERVATORY,
Manila, July 18, 1903.

To the honorable Executive Secretary Civil Governor Philippine Islands.

SIR: His excellency the civil governor and the Commission, having on their part authorized the chief of the Philippine weather bureau to erect a meteorological station on the island of Guam, in view of the great importance of such station for the forecasting of typhoons likely to endanger the shipping interests in the seas of this archipelago, I beg of your honor to advise this bureau concerning the necessary steps to be taken with the naval authorities in control of Guam; or, better still, to use your influence with them in order to secure for the undertaking their good will and necessary cooperation.

Besides the probably necessary authorization on the part of the authorities holding jurisdiction over Guam to establish the station and the good will toward the established outpost, there are chiefly two points for which the cooperation of the United States Navy authorities is very much needed.

I. The transportation of the observer and his instruments to Guam on the next vessel of the United States Navy going thither.

II. The securing of a building or part thereof suitable for the installation of the instruments and habitation of the observer either at the marine station or in Agana.

It may be well to point out to said authorities that the insular government will defray all expenses incident to the erection and maintenance of the station.

Respectfully, yours,

JOSÉ ALGUÉ,
Chief of Philippine Weather Bureau.

THE GOVERNMENT OF THE PHILIPPINE ISLANDS,
EXECUTIVE BUREAU,
Manila, July 20, 1903.

SIR: I have the honor to acknowledge receipt of your communication, under date of the 18th instant, in which you request that the good will and aid of the naval authorities be secured to facilitate the establishment of a meteorological station on the island of Guam, and to inform you that the matter has on this day been taken up direct by the civil governor with the admiral commanding the Philippine Squadron, United States Asiatic Fleet. You will be promptly informed of the action taken by the naval authorities as soon as known.

Very respectfully,

A. W. FERGUSSON,
Executive Secretary.

The DIRECTOR OF THE PHILIPPINE WEATHER BUREAU.

THE GOVERNMENT OF THE PHILIPPINE ISLANDS,
EXECUTIVE BUREAU,
Manila, July 30, 1903.

SIR: Referring again to your communication of the 18th instant, in which you request that steps be taken to secure the cooperation and good will of the naval authorities to facilitate the establishment of a meteorological station on the island of Guam, I have the honor to inform you that advice has just been received from the admiral commanding the Philippine squadron that the naval station at Guam is a separate and independent station, and suggesting that the naval governor of that place be communicated with direct, requesting him, in case he has not the necessary authority, to forward the communication by mail or cable to the Navy Department, Washington, D. C. The suggestion of the admiral has been followed, and you will be promptly informed of the answer of the governor of Guam when the same is received.

Very respectfully,

A. W. FERGUSSON,
Executive Secretary.

The DIRECTOR OF THE PHILIPPINE WEATHER BUREAU.

The observer for Guam is already appointed and ready, and owing to the fact that the Commercial Pacific Cable Company did not grant to the government the free transmission of weather reports from Guam, the observer has been especially instructed to send cablegrams only when the weather will indicate any disturbance which might become dangerous to this archipelago, these telegrams to be paid for by the insular government.

An idea of the inspection of the stations and of the usefulness of such inspection may be derived from the following original reports:

MANILA, *February 14, 1903.*

SIR: In compliance with your instruction of the 31st of January, I have the honor to report that after having taken repeated barometric observations at the hours of the maximum and minimum oscillation, I found that the Tonelot barometer of the station of Olongapo is 1.46 mm. too low compared with the standard barometer. I have therefore applied the correction of 0.63 mm. instead of the former correction of -0.83 mm. which was employed. In my opinion the change has been brought about by the settling of the mercury in the cistern owing to the instability of the house in which it is placed, for the house moves greatly, especially when the wind blows strongly from the second and third quadrants, because the house receives the full force of the wind from those quadrants. The proprietor, however, promised that before the end of the month the work which is required to make the house firm will be finished. All the instruments of this station are well mounted and in very good order.

In the station at Iba the Tonelot barometer was mounted, and after comparison with the standard I found that no correction was necessary. I also found in very good order all the other instruments with the exception of the Wild anemometer, which, however, on my arrival I caused to be arranged. This was done with the help of six men which the president put at my disposal. I then gave the observer a few instructions to help him to the better fulfillment of his duties. The house is fairly good in condition, ventilation, and size, as is also the thermometer screen.

The station at Masinloc is situated in a small but very strongly built house. All the instruments were in good condition and were working well. After comparing the syphon barometer with the standard I changed the correction from -1.10 mm. to $+3.70$ mm.

I send herewith the typhoon barometer taken from the station at Iba and the account of the expenses incurred during the voyage.

Very respectfully,

PEDRO BALTASAR.

Rev. JOSÉ ALGUÉ,

Director of the Philippine Weather Bureau.

MANILA, February 26, 1903.

SIR: In giving account of the visit which I made to the stations of Arayat (Pam-panga) and San Isidro (Nueva Ecija), according to your instructions received on the 18th of the present month, I have the honor to say that in Arayat the new Tonelot barometer has been mounted in the place of the typhoon barometer, which till recently was employed in this station. The mean of the differences found in five readings of the two barometers was -0.79 mm. for the typhoon barometer, although the barometer was well mounted, together with seismometer, in a suitable house. I found the thermometer screen with the thermometers in good condition, as well as the Wild anemometer, which is placed at a convenient height. All these instrument were in good order and are working well.

In comparing the Tonelot barometer at San Isidro with the standard one I found that the former was -0.15 mm. Adding this number to the former correction of 3.20 mm. and 2.66 on account of the height of 28 meters, it follows that the total correction is $+6.01$ mm., which correction has been in use since 2 p. m. of the 24th of the present month. There is no anemometer in this station and there is but an iron quadrant fixed to the top of the thermometer screen, in which are placed the new maximum thermometer and the wet and dry thermometers, which were substituted for the old German instruments. These old thermometers, together with the typhoon barometer taken from Arayat, I have to-day handed over to the mechanics of the Central Observatory. The observer, Julio Catapang, informed me that his predecessor, Carlos Punsalang, did not hand over the anemometer and the counter because he said that they were his own property.

Very respectfully,

PEDRO BALTASAR.

The DIRECTOR OF THE PHILIPPINE WEATHER BUREAU.

MANILA, March 1, 1903.

SIR: In accordance with instruction received from you in your letter dated February 12, authorizing me to make inspection of various meteorological stations in the south of the archipelago, I took passage on the chartered transport *Hai-Mun*, embarking in the port of Manila on the afternoon of the 14th. We sailed the same night, touching for a couple of hours next morning at Batangas, whence we directed our course to Iloilo. As these stops were scheduled beforehand and the time of stoppage extremely short, and as moreover Father Ferrer was to make an official inspection of the Iloilo station in a few days, I did not attempt to visit the station. From Iloilo the steamer crossed over to Puerto Princesa in the island of Paragua. Remaining overnight in this port, we started for Jolo early in the morning, arriving at this point shortly before noon on the following day. On disembarking I immediately visited the meteorological station and inspected the apparatus. I found the instruments installed in the upper portion of the tower which stands on the stone pier jutting out into the harbor. This position seems to be the most convenient place for the station that could be chosen in the neighborhood of the town, as the town itself is low and covered with large trees, where it would be difficult to find a satisfactory position for the installation of the anemometers. All the instruments were found in good condition, and the work of the observer, Roman Aquino, seems satisfactory.

The next station visited was that of Zamboanga. Here the instruments are installed in an upper apartment of the old fort and on the open space behind the parapet overlooking the sea. No better position could be chosen for the installation of the meteorological and seismical instruments, but owing to the fact that for some months past the said room has been turned into a lodging room for several members

of the signal corps, no slight inconvenience is experienced by the observer, who lives in the town outside the fort, in taking his observations at the proper times, since he is frequently deprived of free access to the observatory at hours when his observations and his attention to the instruments would be most useful. It would be very advisable if some arrangement could be made with the military authorities in charge of the fort by which the part of the apartment destined for the observatory might be separated by a partition from the part used as a lodging, in case the room can not be vacated altogether by the signal corps, for the danger of having the more delicate instruments meddled with during the observer's absence by curiously inclined persons who may have the freedom of the room is by no means imaginary. Moreover, such an arrangement would leave the observer more free to take his observations and attend to his instruments at the hours that are most convenient for the proper discharge of his duties.

After examining all the instruments, which were found in excellent condition, I prepared to visit the station at Isabela de Basilan. There was no regular boat to take me thither the next day, but through the courtesy of Brigadier-General Sumner, who generously offered me the use of his small steam launch, I embarked early on Saturday morning from Zamboanga and crossed over to the island of Basilan, where we arrived at Isabela about 10 a. m. I went immediately to visit the station. The instruments I found well installed in advantageous position on an open space in an angle of the fort on the top of the hill. The thermometers are well protected by the original thermometer shelter with nipa roof devised by Father Ferrer. The service of the station by the observer, Antonio Pereira, leaves nothing to be desired, who, thanks to the courtesy of the commanding officer of the port, Captain Mahoney, has every facility afforded him for carrying on the work of the station without inconvenience.

I returned in the launch the same night to Zamboanga and took the *Hai-Mun* on her return from Parang-Parang, arriving in Manila on the morning of February 26.

Respectfully,

W. A. STANTON, S. J.

Rev. JOSÉ ALGUÉ, S. J.,
Chief Philippine Weather Bureau.

STATION AT DAGUPAN, May 4, 1903.

DEAR SIR: On the 22d April I left for Bolinao, where I arrived on the 23d, after spending thirty-six hours in a small boat. On the 26th I again set out for home, which I reached on the night of the 27th after twenty-five hours on the journey.

The Bolinao station is situated in a small, low house, while close to it in the third and fourth quadrants are some cocoo trees about 10 meters high. I therefore told Señor Santos to place a cloth weathercock on the top of a bamboo of some 16 or 20 meters high, or to place it on a tree which was close by the house. This weathercock would be of no use during a typhoon.

The thermometers are placed in a louvered screen which is fastened to the south side of the house and at a distance of some 2 meters above the ground, but the screen closes badly so that the thermometers register the temperature of the interior of the house. I charged Señor Santos to make a better door, and that if he could not do so of wood then he could employ bamboo, for the presidente could not give any help in the matter on account of the want of funds.

The rain gauge is placed on a terrace built of light material, and is about three meters high. The barometer has not a good position, but they say that the presidente will provide a good support for it. The seismograph is very well mounted, as it is fixed to a fine post quite distinct from the house.

The house does not lend itself well to the object, but the presidente told me that he will arrange a place for the station in his house.

That the storm signals be seen from the sea they ought to be hoisted on the top of the church, and they should be very large. There is nothing more than a telephone for the communications and that is very often interrupted, and even when it is in good working order the telegraph station at Alaminos is so often crowded with work that they can not attend to the calls from Bolinao.

Very respectfully,

TORIBIO JOVELLANOS.

Rev. JOSÉ ALGUÉ,
Director Philippine Weather Bureau.

MANILA, *March 5, 1903.*

DEAR SIR: In my visit of inspection of the stations established in the Visayas, which began on the 16th February and ended on the 2d March, I could only visit the following stations: Iloilo, Tacloban, Cebu, and Ormoc. The station at Iloilo has been moved from the site it held formerly, and is now in a building owned by the provincial governor in calle Carlos N. 16, that is on the highway between Iloilo and Molo. The building consists of two floors built of wood, with a zinc roof. In one room of the upper floor are placed the instruments and another room serves as office. The observer and his family occupy the lower floor. On a small tower which has been built next to the room where the instruments are installed the anemometer is very suitably mounted. There is a small piece of land looking on the street in front of the house, and on the other side there is enough land to serve as a meteorological park. This land at the present time is occupied by government stables. One drawback to the house is that it can not be seen from the sea, though it will very probably be visible when a tower which is proposed is built.

The apparatus installed temporarily on the lower floor are in very good order.

I could not visit the station of Calbayog for want of time, because the steamer anchored some distance from the beach in front of the military encampment, which is about 2 miles from the town, and she only stopped for three hours. When such a journey is contemplated again, it will be well to advise the observer beforehand so that he may have a boat ready. I spoke with the observer, Pio Santos, and I gave him the psychrometer and gave him a few instructions on its installment and use.

I did not go on shore at Catbalogan, because the observer, Mr. Cullen, came on board and took his instruments, so that no time was left over. He has a Tanelot and will send his Fortin barometers. He has the anemometer mounted on a small island about 5 miles from the town. The two places are joined by telephone. The position is an excellent one and much better than the town itself, because the mountains do not allow the air to circulate freely there.

I found the observer at Tacloban also in a new house, where he had all the instruments mounted except the seismometer, which still remains in the old house. The mounting of this last instrument leaves much to be desired, because it is fixed to a beam of ordinary wood about 5 meters high and having a diameter of 1 meter. Although this support is not fastened to the floor, still when the window is opened the whole of the apparatus moves on account of the superficies of the box being presented to the wind. The thermometer screen ought to be changed; it is of wood louver work and very small, so that in rain squalls the thermometers are wetted by the rain. On account of the smallness of the screen the thermometer can not be placed upright, a position which greatly facilitates the reading of the instruments. It is impossible to mount the whirling psychrometer. The observations taken on the maximum and thermometers can not be relied upon, since the first is installed vertically and the second has three or four interruptions in the column of alcohol. The observations of the state of the sea are untrustworthy, because the observer told me that he always calls the sea "rather rough." I think that it will be good to translate the station definitely to the place given by the governor, namely, the old office of the captain of the port, which, besides being on the seashore, is close to the principal buildings and the commercial part of the town. There is a little hill at one side which would serve admirably for the anemometer.

The station at Cebu ought, I think, to be changed to some other site. As the work on the port has been approved, we run the risk of being forced to move the station, especially as the present captain of the port does not wish to have the meteorological station fixed in the office of the captain of the port. The instruments are in good working order.

In Ormoc I had to caution the auxiliary observer to be more careful in keeping the thermometers clean. The rest of the instruments were in good order. The results of the comparison of the barometer were very satisfactory. For the barometer in Iloilo the correction was $+0.05$ mm. (two observations); the barometer at Tacloban, -0.03 mm. (three comparisons); the barometer at Cebu, -0.02 mm. (three comparisons).

All these corrections are small, and I was not, therefore, to change the corrections in use.

Very respectfully,

BALTASAR FERRER, S. J.

DIRECTOR OF PHILIPPINE WEATHER BUREAU.

MANILA, *March 23, 1903.*

DEAR SIR: The apparatus of the meteorological station of Romblon has been transferred from the house in which it was formerly to another house, the deed for which house I inclose.

The thermometer screen, which the observer had on a plot of ground belonging to the municipality, has also been transferred to a small terrace adjoining the present house, from where the observations can be easily and accurately taken. The pluviometer remains on the ground in the plot of ground above mentioned.

The barometer, the barograph, and the seismograph are each placed on the different supports of the house, which are of the better kind of wood, the least diameter of the said supports being 32 centimeters. The house is an old one, but very solidly built of wood, with a nipa roof. The principal room of the house, in which the instruments are placed, measures 9.70 by 6.65 meters.

The Wild anemometer is placed on the right of the outside of the house on an ipil support of 28 centimeters diameter. The post is sunk a meter in the ground. The hole in which it is placed is lined with marble. The cups of the anemometer are about a meter above the roof of the house. The winds from the east, north, and northwest are well recorded, but from the other directions not quite so well, because the wind is hindered by the high mountains and by the houses of the center of the town, which is some 600 meters distant. The iron bar which carries the apparatus is fitted into a hole made in the top of the ipil support. This hole is filled up and covered with tar to prevent water lodging there and rotting the wood. This hole is again protected by a triangular piece of wood, to the three corners of which are fastened wires, which thus keep the whole structure very firm. The correction for the Tonelot barometer is -0.20 mm., $+0.57$ mm. for the height of 6 meters above the level of the sea, i. e., the total correction is $+0.37$ mm.

I say just a few words concerning the bad arrangement of the old house. The barograph and the seismometer were on a broken table, the Green barometer was simply hung upon a bent post, and the whole of the instruments were in a room which was occupied by the observer and the servants of the house. I inclose the bill of the expenses incurred during this commission.

Respectfully, yours,

PEDRO BALTASAR.

THE DIRECTOR OF THE PHILIPPINE WEATHER BUREAU.

MANILA, *August 3, 1903.*

DEAR SIR: According to the order received from you of collecting data concerning the leasing of the old house which served as station in Tacloban, I have the honor to report that according to the actual notary public, D. Daniel Orestes Romuáldez, it was Rev. Father Miguel Saderra Mata, and the observer, Señor Balboa, who made the contract with the landlord, D. Dionisio Esperas, when the station was established. The rent was 15 pesos per month. The observer, Balboa, left Tacloban in the month of January, 1902, and D. Vicente Orestes Romuáldez undertook the work of observer in the meantime, according to orders received from the Central, till the following May, when he underwent the examination in Manila. He was then informed that the observer ought not to pay for the rent of the house, but the government, according to the law on this particular, and Vicente Romuáldez on his return to Tacloban communicated this notice to the landlord of the house.

Neither the observer nor the landlord took any steps in the matter with the government till the month of November, when the two together went to the treasurer, who refused to pay, saying that in the government building there was place for the station, and that he did not know that there existed a meteorological station in the town.

The observer therefore seeing that the place pointed out by the treasurer was not large enough for the installation of the instruments, and that there was no other room which could serve as a bedroom, hired a room and paid the rent corresponding to the months of December, January, and February out of his own money. He then transferred the station, with the consent of Reverend Father Ferrer, who happened to be in Tacloban at the time, to his own house.

I found the instruments in this house, in moderate condition, though the whirling psychrometer, the anemometer, and the seismometer had not been mounted. All these instruments were handed over by D. Vicente Romuáldez to the present observer, D. José M. Sison. Below I give the inventory.

It was resolved by the provincial council, in a session which was convened by the governor, and in which the present writer took part, to advise what was necessary for the adequate installation of the station, to hire a private house, at a rent of 30

pesos per month, and to give this house for the station. In the principal room of the house several uprights of strong wood have been placed, and on these the barometer, barograph, and the seismometer have been mounted. This room also serves as the office of the observer.

The quadrant, wind vane, and the Wild anemometer have also been mounted on strong uprights 9.5 meters high. The thermometer screen is situated on a small plot of ground near the house, and the instruments are working well. The pluviometer is also on the same plot of ground, and is in good order.

I took my observations for the purpose of measuring the height of the barometer above the level of the sea, and I found that the elevation was 6 meters, or $+0.57$ mm., and the instrumental error was -0.30 , thus making a total correction of $+0.27$ mm.

I include an account of the expenses incurred during this commission.

Very respectfully,

PEDRO BALTASAR.

Rev. JOSÉ ALGUÉ,
Director of Philippine Weather Bureau.

I finish all the matter concerning the station with a brief report of an intelligent witness about the installation and work of one of our stations.

HEADQUARTERS DEPARTMENT MINDANAO AND JOLO,
OFFICE OF JUDGE-ADVOCATE.

MY DEAR SIR: * * * You have quite a good station at Zamboanga, and apparently well conducted. The exposure is good for temperature, winds, and humidity.

* * * * *

Very truly, yours,

J. P. FINLEY,
Captain, Twenty-seventh Infantry.

Rev. JOSÉ ALGUÉ, S. J.,
Director of Philippine Weather Bureau.

B. NEW INSTRUMENTS AT THE CENTRAL OBSERVATORY AND BRANCH STATIONS.

A universal Vicentini's microseismograph has been constructed by the mechanics. The device for vertical movements has been modified and a combination of brass spirals has been introduced instead of a steel spring. This instrument has been set up in the seismic department and works very satisfactorily.

A new ceraunograph has also been constructed.

Both instruments will be exhibited at the St. Louis Exposition in the Philippine weather bureau station.

A Jordan's sunshine recorder was sent to the station at Catbalogan for experiment.

The statoscope.—This is a new instrument which consists essentially of a series of very delicate and thin membranes inclosed in the interior of a reservoir closed by a stopcock. This system registers the slightest differences between the open air and that of the reservoir as the interior of the membranes communicates with the atmosphere. With this instrument the movement of the mercury in the barometric column is so amplified that 1 millimeter of the column of mercury is equivalent to 25 millimeters on the registering cylinder. The difference of pressure of one hundredth part of a millimeter is therefore appreciable.

The curves of this instrument during thunderstorms, squalls, gusty, and any kind of cyclonic weather are exceedingly valuable. We expect to publish soon some of the results. (See figure 1.)

Electric chronograph.—Another new instrument which the observatory acquired during the present year is a chronograph, which is employed for transmitting the official time to the different stations in the Philippines. The chronograph consists of a cylinder moved by clockwork, the movement of which is regulated by an isochronic regulator of the Foucault type. A small carriage carrying an electro-

magnet, to which a style is attached, is moved along a rail, and thus traces a helicoidal curve on the paper. The cylinder may be made to turn once in one minute, in six seconds, or in one second, thus causing 1, 10, 50 centimeters of paper to pass before the style per second. In the last case one-half millimeter of paper passes in front of the style in one one-thousandth second.

Actinometrograph (system Violle).—Since January, 1903, another new instrument has been set up in the open-air station of this observatory; an actinometrograph, which works very satisfactorily. (See plate A.)

Evaporimetrograph (system Houdaille).—Besides the new instruments already spoken of, there is another which is not generally known, namely, a self-registering vaporimeter. This was obtained from the well-known makers of instruments of precision, Richard Frères, of Paris. It consists of a closed receptacle containing water, in which the water is drawn up by capillary attraction and wets a sheet of blotting paper of a determined size. A float transmits to the pen the height of water in the vessel, so that the displacements of the pen are proportional to the amount of water evaporated, and the sharpness of the curve gives the degree of evaporation.

This instrument has the same advantages as the Piche vaporimeter, without its disadvantages, in this, that increase of temperature or fall of pressure can not cause the water to escape. Moreover, the blotting paper is always wetted in the same way, because the fall of the liquid is not more than 5 millimeters. (See fig. 2.)

C. TELEGRAPHIC SERVICE AND WORK IN BRANCH STATIONS.

A rather sad event occurred at the end of the last fiscal year, the withdrawal of the operator from the observatory, which had a telegraphic station without interruption since the year 1880. Following are the documents relative to this event:

HEADQUARTERS DIVISION OF THE PHILIPPINES,
OFFICE OF THE CHIEF SIGNAL OFFICER,
Manila, P. I., June 10, 1902.

SIR: Owing to the depleted force of telegraph operators now in the signal corps in this division, it has become a necessity to close the telegraph offices at the observatory and the Eastern Extension Cable Company's office in Malate. The superintendent of the cable company informs me that when this is done the delivery of weather report can not be undertaken by his company, and he requests that you make arrangements for receipt of same.

It is requested that you make these arrangements and any others that are made necessary at your convenience and notify this office when completed, when operator will be withdrawn.

Very respectfully,

W. A. GLASSFORD,
Major, Signal Corps, U. S. Army, Chief Signal Officer

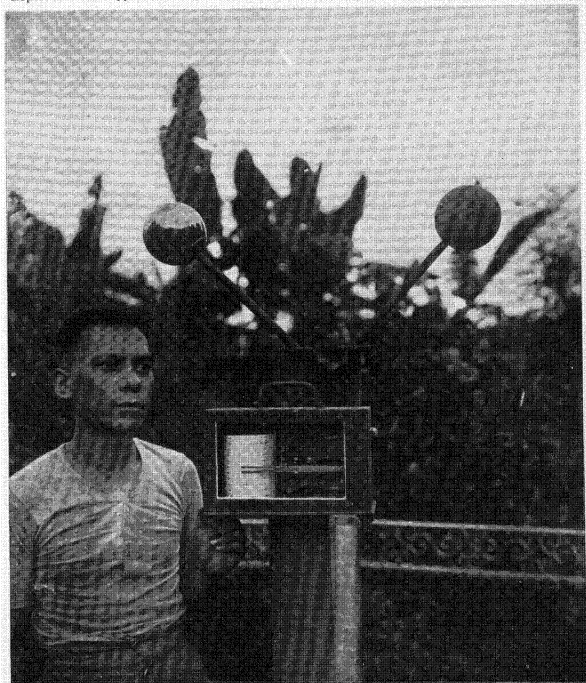
Rev. JOSÉ ALGUÉ, S. J.,
Director of Manila Observatory, Manila, P. I.

Immediately on receipt of the above letter I went to see personally Major Glassford to explain matters. The Major was not in his office and I proposed my reasons to the chief clerk of the headquarters of the signal corps. The result is the following letter:

HEADQUARTERS DIVISION OF THE PHILIPPINES,
OFFICE OF THE CHIEF SIGNAL OFFICER,
Manila, P. I., June 13, 1902.

SIR: I have to inform you that it is impracticable to allow the signal-corps operator to remain on duty at the observatory, as his services are urgently needed elsewhere.

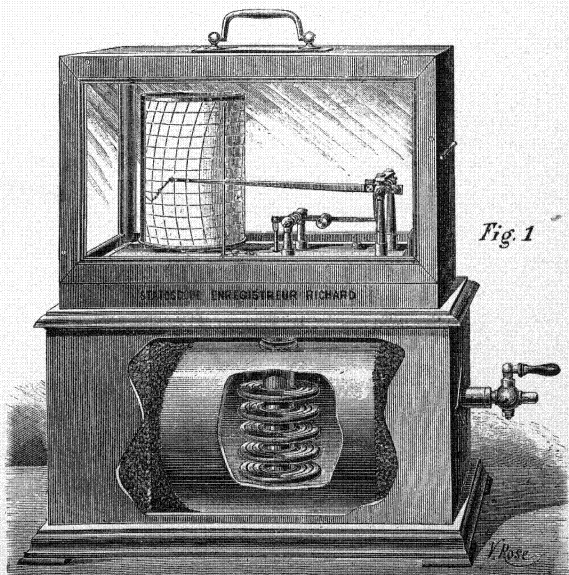
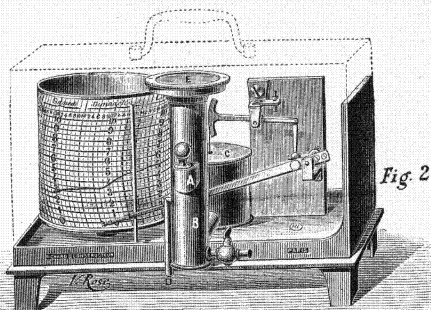
It is therefore suggested that you secure authority to employ a civilian operator—one able to work on our lines and not delay our business—to be considered as part of the personnel of your bureau and to be paid from funds appropriated for same.



THE ACTINO-METROGRAPH (VIOLE).

EVAPORIMETROGRAPH

HOUDAILLE



The lowest salary for which an American operator in the Philippines will labor is \$100, United States currency, and if you secure authority for the employment of one this office will undertake, if desired, to secure the operator.

It is desired that this matter be dispatched as much as possible.

Very respectfully,

W. A. GLASSFORD,
Major, Signal Corps, U. S. Army, Chief Signal Officer.

Rev. JOSÉ ALGUÉ, S. J.,
Director of Manila Observatory, Manila, P. I.

I sent these two letters to the acting secretary of the interior with the following note:

I am in receipt of the following two letters which I respectfully submit to you for settlement, together with information of the steps taken by this bureau in regard to such serious matter.

As the result of my letter to Major Glassford, the chief of the signal corps sent to the vice-governor his indorsement to it which reads as follows:

MANILA, P. I., June 16, 1902.

JOSÉ ALGUÉ, *Director Weather Bureau:*

Relative to the withdrawal of the operator from the observatory and from Malate by the chief signal officer.

[Third indorsement.]

HEADQUARTERS DIVISION OF THE PHILIPPINES,
OFFICE OF CHIEF SIGNAL OFFICER,
Manila, P. I., June 27, 1902.

Respectfully returned, through the adjutant-general of the division to the civil governor of the Philippine Islands.

The signal corps deeply regrets closing the telegraph office at the observatory, as will be seen by letter from this office dated the 13th instant, included in body of this paper, but it believes that, this matter being so wholly weather bureau work, the appropriation for that bureau should cover the expenses of the operator, and not the army signal corps appropriation. However, the enlisted men of the signal corps on duty at the observatory and cable office, Manila, must be withdrawn to best subserve the interests of the islands' telegraph service, owing to the depleted force of army telegraphers.

My own feelings are wholly sympathetic toward the weather bureau work, as I was myself a forecaster in Washington for many years.

We can not longer spare the three operators the present arrangement requires. I therefore beg to suggest the approval of the director's plan of substituting a messenger service.

(Signed)

W. A. GLASSFORD,
Major, Signal Corps, U. S. Army, Chief Signal Officer.

Copy respectfully furnished the civil governor of the Philippine Islands, Manila, P. I.

W. A. GLASSFORD,
Major, Signal Corps, U. S. Army, Chief Signal Officer.

[First indorsement.]

OFFICE OF THE CIVIL GOVERNOR OF THE PHILIPPINE ISLANDS,
Manila, P. I., July 7, 1902.

Respectfully returned to the Rev. Father José Algué, director Philippine weather bureau, calling his attention to the within communication from Maj. W. A. Glassford, chief signal officer, Division of the Philippines.

It seems that the operators heretofore employed at the observatory are now no longer available. The messenger service suggested by Major Glassford it is hoped may be installed and will meet the necessities of the case. In the event this does not answer the requirements of the situation, information is desired as to whether telegraph operators can be found and employed, and at what price.

LUKE E. WRIGHT,
Acting Civil Governor.

In the meanwhile the following letters were received:

DIVISION OF THE PHILIPPINES,
OFFICE OF THE CHIEF SIGNAL OFFICER,
Manila, P. I., June 18, 1902.

SIR: I have to inform you that the operator of the signal corps now on duty at the observatory will be withdrawn on June 30, and also the operator at the cable office, because of the great need of operators on the telegraph lines due to the expiration of service and the return of such operators to the United States. During the last two months we have lost about 80 men, and during the present month we will lose nearly half this number. I hope you can make arrangements at once to have Mr. Manchester, or some of the students at his school, to supply the places of these signal corps men.

I realize the importance of the weather service fully, but it should be kept in mind that the signal service of the Army has no connection whatever with the weather service and has had none since 1890.

As to the matter of time, that is sent over the telegraph wires daily, and if the cable authorities wish to send it, it would seem that arrangements might be made by which they could do it independent of a wire belonging to the signal corps. However, we will do anything in our power in the way of furnishing wire for your purposes.

Very respectfully,

W. A. GLASSFORD,
Major, Signal Corps.

Rev. JOSÉ ALGUÉ, S. J.,
Director of Manila Observatory, Manila, P. I.

UNITED STATES SIGNAL CORPS,
MANILA, June 23, 1902.

Professor ALGUÉ,
Observatory, Manila:

Owing to sickness of operators, of which there are 20 men sick in Manila hospitals to-day, I am under this emergency compelled to relieve Sergeant McGurk from cable office to-morrow morning. The other men will follow shortly. Please make arrangements anticipating this.

GLASSFORD.

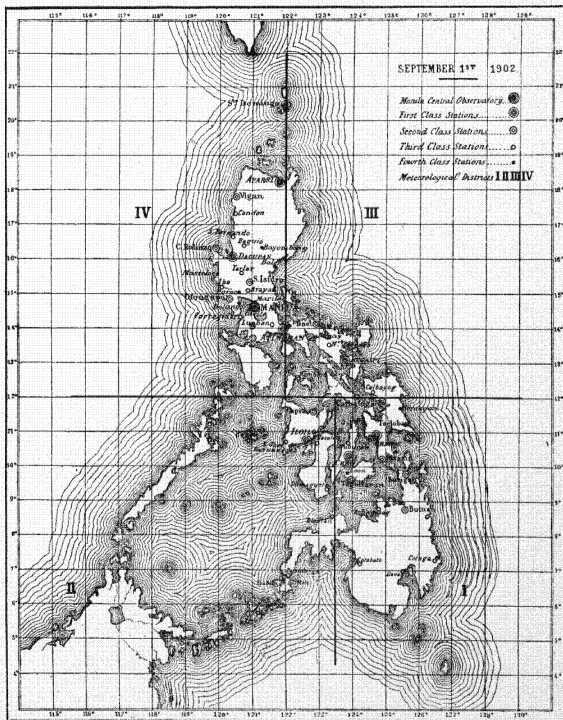
Since July, 1902, we had to use messengers to bring the telegrams from the central telegraphic station and to send our report to the telegraph station. In July, 1903, it was decided by the Commission to add to our force one first-class observer, to be operator in our station. Accordingly I proposed the plan to Major Glassford, chief signal corps, who ordered a special and independent wire connecting the central telegraphic station and our observatory to be laid for the prompt transmission and dispatch of weather telegrams. This plan has been in operation since the 1st of August, 1903.

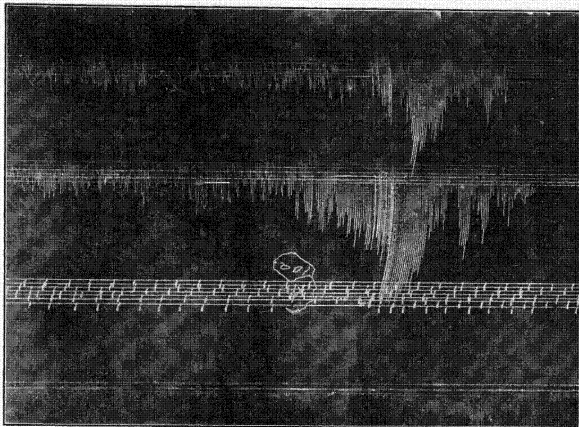
D. EARTHQUAKE RECORDS.

All the stations in the new service in the Archipelago are also considered as seismic stations, as we have already said when speaking of the various apparatus. Hence in all of them a minute and exact record is taken of all earthquakes, no matter how small they may be, provided they are perceptible. Record is kept of the exact hour of the earthquake, the duration, character of the movements, and the directions of same, and finally their intensity. These last three points can be easily deduced from the curves traced by the pendulums, excepting, however, the movements that are purely vertical. The hour and duration is also recorded automatically by means of a simple seismoscope. This latter consists essentially of a drum moved by clockwork and an electric circuit which is closed by the movement of the pendulum.

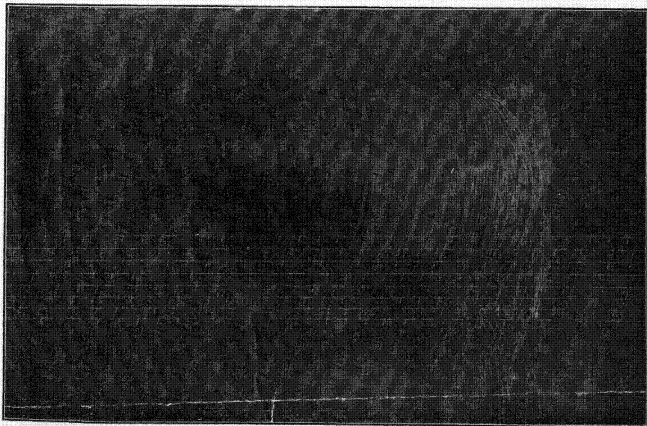
PHILIPPINE WEATHER BUREAU METEOROLOGICAL DISTRICTS AND STATIONS

A





THE GUAM EARTHQUAKE.



A LOCAL EARTHQUAKE.

Besides the above earthquake data, the observers are advised, in order that our material may be as complete as possible, to send a minute description not only of the effects of the earthquake, but also of the phenomena that usually accompany it, or that are supposed to have any relation to it, such as subterraneous noises, volcanic or electric displays, or terrestrial or atmospheric currents which usually affect cables and telegraph or telephone lines.

In the central observatory a great number of records have been registered on the Vicentini microseismograph. I will call attention in particular to two—the first the Guam earthquake which took place about 11.15 a. m. of September 22, and the second the local earthquake of November 17. I take these two examples because the two curves are typical in character, the first of a distant earthquake and the second of a local one. We take the notice of the Guam earthquake from the account published in the weather bulletin for September, and we reproduce here the curve as recorded by the Vicentini microseismograph:

The earthquake was registered at the observatory by the Vicentini microseismograph and by the unifilar and bifilar magnetographs. On the photographic curves of these last instruments, as well as on the curves of the Vicentini apparatus, four principal maxima of oscillation are well marked—that is, four distinct periods separated by intervals of some seconds, corresponding no doubt to four shocks of maximum destructive force. The oscillations of the Vicentini, as well as those of the magnetographs, show an amplitude that only occurs when the origin of the earthquakes is not so very far distant, and which, besides proving the violence of the earthquake in those islands, go to show that its center was probably located in the sea to the west of the Marianas. The discrepancy found in press accounts regarding the exact time when the earthquake took place (11.15, 11.25, 11.45 a. m.) prevents us from calculating the distance of the focus from Manila, supposing that the large surface waves have a mean velocity of 2.51 kilometers per second, which is the velocity found by various authorities for distances between 1,000 and 4,000 kilometers. In the note we gave to the press on October 8, as soon as the news of the earthquake reached Manila, we calculated the velocity of the waves by taking as the true hour 11.15 a. m., and by supposing that the superficial or spherical distance between Manila and Agaña is 2,700 kilometers; the result gives us 3.1 kilometers per second. Considering large surface waves, this value is, as we stated in the note, rather excessive; whereas referred to the smaller preliminary waves, which lasted here some thirty seconds, it is too small. The waves of largest amplitude lasted more than one minute. The vertical pendulum had two periods of maximum oscillation, separated by an interval of four minutes; the great amplitude of its oscillations indicates a large vertical component. This, taken in connection with the excessive velocity found for the surface undulations, which resulted from taking the island of Guam as the center of disturbance, may really indicate a greater proximity of the same; but taking into account the wide differences that exist in the published accounts regarding the exact time of the earthquake, it is impossible to make any reliable calculation.

We also take the account of the local earthquake from the one published in the bulletin for November and reproduce here the curve traced in the observatory:

An earthquake took place this morning (November 17) at 8^h 37^m 56^s, without any preliminary microseismic oscillations. The first shock as well as the stronger oscillations was in the direction WNW.-ESE. and the lighter ones inclined to N.-S. The rapid succession of shocks gave the sensation of a rotatory movement. The principal oscillations on the various seismographs measure 2° 30', the vertical component being large, thus making the shocks seem strong, while the horizontal movement was small. The total duration of the earthquake, including the last almost imperceptible movements, was fifty-eight seconds.

If we compare this earthquake with the last strong one felt here, namely, that of December 15, 1901, we observe notable differences. The last mentioned had a very small vertical component, notwithstanding the nearness of the focus, which was to be found near Taal Volcano. In to-day's earthquake, on the contrary, the vertical component was large, thus indicating that the radiating center of the waves was

deep, or perhaps nearer to Manila. From the form of the curve traced by the Vicentini microseismograph it can be deduced with some probability that the center of this earthquake is not far away, and therefore it will have been felt with equal or greater force in the provinces. At the moment we are writing this note four imperceptible repetitions have been registered, at 8^h 40^m 16^s, 9^h 5^m 40^s, 9^h 24^m 12^s, and 9^h 31^m, and one very perceptible shock at 11^h 15^m 30^s, always in the same direction as the first.

E. CROP SERVICE.

The crop service in the archipelago was organized in the year 1901, and since that time its sphere of usefulness has been extended and its utility has been demonstrated time after time. The daily papers, both in English and Spanish, have copied the results published in the monthly weather bulletin, and in this manner the reports on crops from the provinces have been disseminated to a larger circle of readers.

To show the usefulness of this service, we give below a list of the municipalities which have contributed to the crop service, together with the provinces to which they belong and the principal crops that are grown there.

For convenience, we reproduce the map published in last year's report, so that the relative positions of the towns and stations may be seen.

The districts refer to the meteorological division of the archipelago.

Province and town.	District.	Most important agricultural products.
Albay:		
Legaspi.....	III	Hemp, rice, cocoanut, corn, cacao, coffee.
Daraga.....	III	Hemp, rice, cocoanut, corn, sugar cane.
Manito.....	III	Hemp, sugar cane, cacao.
Albay.....	III	Hemp, rice, sugar cane, coffee, cacao.
Camalig.....	III	Hemp, rice, corn, cocoanut.
Guinobatan.....	III	Hemp, cocoanut, cacao, corn, sugar cane, coffee, rice.
Tabaco.....	III	Hemp, cocoanut, rice.
Tivi.....	III	Hemp, rice, cacao, sugar cane, cocoanut.
Bacacay.....	III	Hemp, rice, cacao, sugar cane, corn.
Ligao.....	III	Hemp, rice, cacao, sugar cane, cocoanut, corn, coffee.
Oas.....	III	Hemp, rice.
Polangui.....	III	Hemp, rice, cacao, corn.
Libog.....	III	Hemp, rice, sugar cane.
Malilipot.....	III	Hemp, rice, cacao, corn.
Antique:		
San José de Buenavista.....	II	Rice, corn, sugar cane.
Bugason.....	II	Rice, sugar cane.
Tibiao.....	II	Do.
Basilan:		
Basilan.....	II	Corn, sugar cane, coffee, cacao, rice, cocoanut, hemp.
Bataan:		
Balanga.....	IV	Rice, sugar cane, corn.
Bagac.....	IV	Rice.
Hermosa.....	IV	Rice, corn.
Orani.....	IV	Rice, sugar cane, corn.
Samal.....	IV	Do.
Mariveles.....	IV	Rice, corn, cocoanut, cacao, coffee.
Mabatang.....	IV	Rice, sugar cane.
Orion.....	IV	Rice, corn.
Batanes:		
Santo Domingo.....	IV	Ube, ducay.
Benguet:		
Baguio.....	IV	Rice, sugar cane, corn, coffee, potatoes.
La Trinidad.....	IV	Do.
Balagbag.....	IV	Do.
Adocay.....	IV	Do.
Buguias.....	IV	Do.
Gallano.....	IV	Do.
Loo.....	IV	Do.
Bocot.....	IV	Do.
Tublay.....	IV	Do.
Cabayan.....	IV	Do.
Capangan.....	IV	Rice, sugar cane, corn, coffee, potatoes, cacao.

Province and town.	District.	Most important agricultural products.
Bohol:		
Tagbilaran	I	Rice, sugar cane, corn, cocoanut, tabaco.
Corte	I	Rice.
Duero	I	Rice, sugar cane, cocoanut.
Jagna	I	Do.
Laoag	I	Rice, cocoanut.
Inabanga	I	Rice, sugar cane, corn.
Calape	I	Rice, sugar cane, corn, hemp.
Dimiao	I	Rice, sugar cane, corn.
Loon	I	Hemp, tabaco.
Bulacan:		
Marilao	IV	Rice.
Cagayan:		
Camalaniugan	IV	Do.
Abulug	IV	Do.
Claveria	IV	Coffee, cacao, sugar cane, corn.
Malauig	IV	Tobacco, corn, hemp, cocoanut.
Aparri	IV	Rice.
Piat	IV	Rice, tobacco.
Tuguegarao	IV	Rice, tobacco, corn.
Solana	IV	Tobacco, corn.
Camarines:		
Nueva Caceres	III	Rice, corn, hemp, cocoanut, sugar cane, coffee, cacao.
Nabua	III	Rice, corn.
Libmanan	III	Rice, corn, sugar cane, hemp.
Iriga	III	Rice, hemp.
Pamplona	III	Hemp, tobacco, sugar cane, corn, cacao.
Capiz:		
Capiz	II	Sugar cane, rice, cocoanut, buri.
Loctugan	II	Sugar cane, corn, rice.
Pontevedra	II	Do.
Jamindan	II	Hemp, rice, corn, coffee, cacao.
Calivo	II	Rice, sugar cane, tobacco, cocoanut.
Banga	II	Rice, corn, cocoanut, hemp, pineapple.
Panitan	II	Rice, corn.
Dumarao	II	Rice, corn, tobacco.
Mambusao	II	Rice, corn.
Tapas	II	Rice, corn, sugar cane, cacao, hemp.
Sigma	II	Rice, corn.
Libacao	II	Rice, corn, hemp.
Hasan	II	Rice, corn.
Jagnaya	II	Do.
Cuartero	II	Do.
Maayon	II	Rice, corn, hemp.
Tangalan	II	Rice, corn, cocoanut, hemp, sugar cane, tobacco, cacao, coffee.
Ibahay	II	Rice, hemp, sugar cane, tobacco, cacao.
Navas	II	Rice, hemp, cocoanut.
Panay	II	Do.
Macato	II	Rice, hemp, cocoanut, corn, tobacco.
Cebu:		
Danao	I	Rice, corn, sugar cane.
El Pardo	I	Do.
Talisay	I	Sugar cane, corn.
Mandaue	I	Sugar cane.
Opon	I	Rice, corn, cocoanut.
Barili	II	Rice, corn, hemp, sugar cane, tobacco.
Toledo	I	Sugar cane, tobacco, corn.
Tuburan	I	Sugar cane, tobacco, rice, corn, cocoanut.
Liloan	I	Sugar cane, corn.
Balamban	I	Sugar cane, hemp, rice, corn, cacao, tobacco.
Dumanjug	II	Corn, tobacco, hemp, sugar cane.
Talamban	I	Corn, rice.
Consolacion	I	Corn, rice, sugar cane.
Asturias	I	Sugar cane, corn, tobacco, hemp.
San Remigio	I	Corn, rice, sugar cane.
Sogoa	I	Hemp, corn.
Mabolo	I	Corn, rice, sugar cane.
Cebu	I	Corn, rice.
Concepcion:		
Estancia	II	Rice.
Carles	II	Rice, corn, tobacco.
Balasan	II	Rice.
Ajug	II	Do.
Corregidor:		
Corregidor	IV	Corn.
Cotabato:		
Cotabato	I	Rice, corn, sugar cane, tobacco, hemp.
Lubungan	I	Corn.
Dapitan	I	Rice, hemp, sugar cane, cocoanut.
Ilaya	I	Corn, cacao.
Dipolog	I	Hemp, rice.
Tucuran	I	Gutta-percha.

Province and town.	District.	Most important agricultural products.
Davao:		
Davao	I	Hemp, rice, corn, sugar cane, cocoanut, cacao, tobacco, coffee.
Daron	I	Hemp, rice, cacao.
Daliao	I	Hemp, rice, corn, cocoanut.
Mati	I	Rice, corn.
Astorga	I	Hemp, rice, cocoanut, corn.
Matina	I	Rice, lanzon, mango.
Iloco Norte:		
Candon	IV	Sugar cane, cocoanut, rice.
Iloco Sur:		
Vigan	IV	Corn, indigo, cotton, rice, sugar cane.
Santa Cruz	IV	Rice, sugar cane, corn, tobacco, cotton.
Tagudin	IV	Rice, corn.
Lapog	IV	Indigo, corn.
Sinait	IV	Do.
Santo Domingo	IV	Do.
Iloilo:		
Passi	II	Tobacco, rice, corn.
Duenas	II	Do.
Calinog	II	Do.
Lucena	II	Tobacco, rice.
Dumangas	II	Rice, corn.
Pavia	II	Tobacco, rice, corn.
Mandurriao	II	Rice, corn.
Dingle	II	Tobacco, rice, sugar cane.
Santa Barbara	II	Tobacco, rice.
Anilao	II	Tobacco, rice, corn.
Alimodian	II	Rice.
Zarraga	II	Rice, sugar cane.
Oton	II	Rice, corn.
Januay	II	Rice, corn, tobacco,
Lambunao	II	Do.
Pototan	II	Rice, tobacco, sugar cane.
Jaro	II	Rice, sugar cane.
Igbaras	II	Rice, corn, tobacco.
Mina	II	Rice.
Cabatuan	II	Rice, corn.
Molo	II	Cocoanut.
Maasin	II	Rice, corn, sugar cane.
La Paz	II	Rice, corn.
San Joaquin	II	Rice, sugar cane, tobacco.
Leganes	II	Rice.
San Miguel	II	Do.
Nueva Valencia	II	Do.
Isabela:		
Ilagan	IV	Rice, corn, tobacco.
Jolo:		
Jolo	II	Rice, corn.
Leyte:		
Villaba	I	Rice, corn, hemp, tobacco, cocoanut.
Tabing	I	Do.
Ormoc	I	Rice, cacao, hemp, cocoanut, tobacco, corn, sugar cane.
Tabango	I	Rice, corn, hemp, tobacco, cocoanut.
Maasin	I	Do.
Maitbog	I	Hemp, rice.
Dulag	I	Hemp, rice, cocoanut, tobacco, sugar cane, corn.
Tolosa	I	Cocoanut, hemp.
Barugo	I	Hemp, corn.
Merida	I	Tobacco, hemp, corn, sugar cane, rice.
Baybay	I	Hemp, corn.
Cambusay	I	Hemp, rice, cacao, sugar cane.
McCrohon	I	Hemp, cocoanut, rice, cacao, sugar cane.
Amparo	I	Do.
Naval	I	Corn, rice, hemp, sugar cane.
Misamis:		
Balingasag	I	Hemp, rice, cocoanut, cacao, corn.
Rosario	I	Hemp, rice, corn.
Tagoloan	I	Corn, tobacco.
Salay	I	Cocoanut, rice, corn.
Jasaan	I	Corn, tobacco.
Negros Oriental:		
Dumaguete	II	Sugar cane, hemp, corn, rice, cotton.
Ayquitán	II	Hemp, corn, rice, cocoanut, cacao, coffee.
Tayasan	II	Corn, tobacco, cacao, sugar cane.
Bais	II	Rice, sugar cane, corn.
Taujay	II	Do.
Bacon	II	Sugar cane, corn, hemp, rice, cacao, cotton, coffee.
Siaton	II	Rice, corn, hemp.
Nueva Valencia	II	Hemp.
Dauin	II	Hemp, rice, corn.
Escalante	II	Rice, hemp, cacao, tobacco.
Negros Occidental:		
Saravia	II	Sugar cane, rice, corn.
Guimbalaon	II	Sugar cane, corn.

Province and town.	District.	Most important agricultural products.
Negros Occidental—Continued.		
E. Lopez.....	II	Sugar cane, corn, rice.
Bacolod.....	II	Sugar cane, corn, rice, cocoanut, cacao.
Granada.....	II	Sugar cane, hemp, corn.
Binalbagan.....	II	Sugar cane, corn, rice.
Calatrava.....	II	Sugar cane, corn, hemp, cocoanut, tobacco, cacao.
Cadiz.....	II	Sugar cane, cocoanut, corn, rice.
Sagay.....	II	Sugar cane, corn, rice, tobacco.
Sumag.....	II	Rice.
La Carlota.....	II	Sugar cane, corn, hemp, rice.
Murcia.....	II	Sugar cane, rice, corn, cocoanut.
Soledad.....	II	Sugar cane, rice, corn, cacao.
Pulupandan.....	II	Sugar cane, rice, corn,
Himamaylan.....	II	Sugar cane, rice.
San Carlos.....	II	Sugar cane, tobacco.
San Enrique.....	II	Sugar cane, rice, corn, cocoanut, nipa.
Isabela.....	II	Sugar cane, rice.
La Castellana.....	II	Sugar cane, rice, hemp.
Manapla.....	II	Sugar cane, corn, hemp.
Ilog.....	II	Rice.
Guiljungan.....	II	Do.
Isio.....	II	Do.
Nueva Ecija:		
Rosales.....	IV	Rice, cacao, coffee, tobacco, corn, sugar cane.
San Isidro.....	IV	Rice, tobacco, coffee, cacao, corn, nipa, sugar cane.
Bongabong.....	IV	Rice, corn.
Santa Rosa.....	IV	Rice, corn, sugar cane.
San Leonardo.....	IV	Tobacco.
Cabiao.....	IV	Cacao, corn, sugar cane, coffee, rice.
Caranglan.....	IV	Rice, corn.
Aliaga.....	IV	Rice, corn, sugar cane, tobacco.
San Quintin.....	IV	Rice, sugar cane.
San Juan de Guimba.....	IV	Rice, corn.
Cuyapo.....	IV	Rice, sugar cane.
Santo Domingo.....	IV	Rice, corn.
Cabanatuan.....	IV	Rice, corn, tobacco.
Pañaranda.....	IV	Rice, corn.
Nanpican.....	IV	Rice, corn, sugar cane.
Jaen.....	IV	Rice, corn, sugar cane, tobacco, cacao, coffee.
Licab.....	IV	Rice.
Uningan.....	IV	Do.
Pampanga:		
Arayat.....	IV	Rice, corn, sugar cane.
Santa Ana.....	IV	Rice, sugar cane.
Candaba.....	IV	Rice, corn, sugar cane.
San Luis.....	IV	Do.
Porac.....	IV	Rice, sugar cane.
Pangasinan:		
Pozorrubio.....	IV	Rice, corn, tobacco, sugar cane, cotton.
Rosales.....	IV	Rice, cacao, coffee.
Alcala.....	IV	Rice, corn, sugar cane.
Bayambang.....	IV	Rice, cocoanut, indigo.
Calasio.....	IV	Rice, cocoanut, sugar cane.
Malasiqui.....	IV	Rice, sugar cane, corn, cacao, coffee.
Dagupan.....	IV	Rice, sugar cane, cocoanut, nipa, corn.
Lingayen.....	IV	Rice, nipa.
Salasa.....	IV	Rice, corn.
Aguilar.....	IV	Rice, corn, sugar cane.
Mangatarem.....	IV	Rice, sugar cane, tobacco, corn.
San Isidro.....	IV	Rice, cocoanut, nipa.
San Nicolas.....	IV	Sugar cane, corn, tobacco.
Alava.....	IV	Rice, corn, tobacco.
Villasis.....	IV	Rice, corn.
San Carlos.....	IV	Corn, sugar cane, cacao, rice, indigo.
Santa Maria.....	IV	Corn, rice, tobacco.
Romblon:		
Looc.....	III	Tobacco, hemp, cocoanut.
Odiungan.....	III	Do.
Banton, I.....	III	Hemp, tobacco, corn, cocoanut, rice.
Romblon.....	III	Cocoanut, hemp, rice, tobacco, corn, cacao, coffee, buri.
Samar:		
Cathalogan.....	I	Hemp, rice.
Calbayog.....	III	Do.
Catarman.....	III	Do.
Surigao:		
Surigao.....	I	Hemp, rice, cocoanut.
Caraga.....	I	Hemp, rice, cacao, tobacco, cocoanut, corn.
Baganga.....	I	Hemp, rice, cacao, cocoanut, corn.
Tarlac:		
Anao.....	IV	Tobacco, corn.
San Clemente.....	IV	Rice, sugar cane.
Paniqui.....	IV	Rice, sugar cane, corn.
Pura.....	IV	Do.
Gerona.....	IV	Do.
Tarlac.....	IV	Do.

Province and town.	District.	Most important agricultural products.
Tarlac—Continued.		
Marcia	IV	Rice, sugar cane, corn.
O'Donell	IV	Rice, coffee, cacao.
Bauban	IV	Corn, rice.
Santa Ignacia	IV	Do.
Moncada	IV	Sugar cane, tobacco, corn.
Capas	IV	Sugar cane, rice, corn.
La Paz	IV	Rice, corn.
Concepcion	IV	Rice, corn, sugar cane.
Tayabas:		
Atimonan	III	Cocoanut, rice, corn, bejuco, hemp.
Isla Alabat	IV	Cocoanut, rice, sugar cane, coffee.
Lopez	III	Hemp, rice, cocoanut, corn.
Calaoang	III	Hemp, rice, cocoanut, brea.
Mauban	IV	Rice, sugar cane, cacao, buri, hemp, cocoanut, cacao.
Barcelona	IV	Rice, cacao.
Lucban	IV	Hemp, rice, cocoanut.
Tayabas	IV	Rice, cocoanut.
Gumaca	III	Rice, cocoanut, hemp, brea.
Union:		
Santo Tomás	IV	Rice, sugar cane, corn, tobacco.
Bangar	IV	Rice, corn, cotton, sugar cane, tobacco.
San Fernando	IV	Rice, tobacco, corn, sugar cane, cotton, cacao.
Bagnotan	IV	Sugar cane, rice, tobacco, corn.
San Juan	IV	Sugar cane, rice, corn, cocoanut, cacao.
Naguilian	IV	Rice, tobacco, corn.
Buluogan	IV	Rice, tobacco, sugar cane.
Zambales:		
Masinloc	IV	Rice, bejuco.
Iba	IV	Rice.
Bolinao	IV	Rice, tobacco, cotton, corn, maguey, sibucan.
Olongapo	IV	Rice.
Alaminos	IV	Indigo, cotton, sugar cane.
San Isidro	IV	Rice, tobacco, sugar cane, corn.
Santa Cruz	IV	Rice, sugar cane.
Zaragoza	IV	Rice.
San Felipe	IV	Do.
Zamboanga:		
Zamboanga	II	Rice, cocoanut, corn, sugar cane.

F. TYPHOON SIGNALS.

DEPARTMENT OF THE INTERIOR,
Manila, October 9, 1902.

SIR: In reply to your letter of October 6, I beg to say that the whole subject of provision of storm signals for the more important ports of the archipelago has been referred by me to the Commission for consideration by that body. I request that you furnish me a list of the ports where, in your judgment, such signals should be displayed, and where they are not displayed at the present time.

Very respectfully,

DEAN C. WORCESTER,
Secretary of the Interior.

JOSÉ ALGUÉ, S. J.,
Director Weather Bureau, Manila, P. I.

PHILIPPINE WEATHER BUREAU,
Manila Observatory, October 12, 1902.

DEAR SIR: In reply to your letter of October 9, I beg to say that storm signals are only hoisted in Iloilo, Cebu, and Dagupan at daytime. Signals have been sent to San Fernando, Aparri, Cabo Bojeador, and Vigan by the hydrographic branch at Manila, but are not in use. I respectfully propose that such day signals be sent for the present to some other important ports, viz, Zamboanga, Romblon, Catbalogan, Tacloban, Surigao, Jolo, Legaspi, Atimonan, Corregidor, Lucena, and Olongapo.

Respectfully,

JOSÉ ALGUÉ,
Director of Philippine Weather Bureau.

The honorable the SECRETARY OF THE INTERIOR.

THE GOVERNMENT OF THE PHILIPPINE ISLANDS,

EXECUTIVE BUREAU,

Manila, February 9, 1903.

SIR: I have the honor to submit for your information the following excerpt from minutes of the Commission of February 4, 1903:

"The recorder presented a communication from the director of the weather bureau furnishing information as to points where storm signals are hoisted and suggesting that such signals be sent to a number of other important points, viz, Zamboanga, Romblon, Catbalogan, Tacloban, Surigao, Jolo, Legaspi, Atimonan, Corregidor, Lucena, and Olengapo. The communication had been referred by resolution of the Commission of December 3, 1902, to the secretary of the interior for investigation as to the amount necessary for carrying out the proposal of the director of the weather bureau and had been returned with recommendation that the sum of \$692, local currency, be appropriated for the purchase of twelve sets of storm signals to be installed and displayed at the ports above mentioned by the employees of the Philippine weather bureau. It was therefore, on motion,

"*Resolved*, That the recommendation of the secretary of the interior be concurred in and that the committee on appropriations be directed to include in the next appropriation bill the amount of \$692, local currency, recommended for the purchase of storm signals."

Very respectfully,

BEEKMAN WINTHROP,

Acting Executive Secretary.

THE DIRECTOR OF THE PHILIPPINE WEATHER BUREAU,

Manila, P. I.

The necessary appropriation finally was made by the Commission in act 682 on the 14th of March, 1903, and reads as follows:

Philippine weather bureau: Contingent expenses: For the purchase and installation of storm signals, not exceeding six hundred and ninety-two dollars, local currency, two hundred and seventy-five dollars.

G. PUBLICATIONS OF THE BUREAU.

1. The first part of the report of the director was published at the end of the fiscal year 1902.

2. The second part of the director's report appeared in June, 1902. It consists of an account of the establishment and development of the meteorological service under the Spanish Government and its reorganization under the Government of the United States.

3. The third part of the report contains the hourly observations of atmospheric phenomena at the Manila Central Observatory during the calendar year 1902, published in July, 1903.

4. The fourth part containing hourly magnetic observations in Manila is under press.

5. The fifth part, which is a résumé of the meteorological observations in branch stations for the year 1902 is also under press.

6. The first pamphlet of a series of theoretical and practical meteorology. Title of the pamphlet "La lluvia" (the rain). The reasons which moves the bureau to publish such a series are given in the following letter:

WAR DEPARTMENT, PHILIPPINE WEATHER BUREAU,

Manila Observatory, May 18, 1903.

DEAR SIR: It has been thought advisable to write a series of instructions for the use of the observers in the different stations scattered throughout the islands, so that each of them may have at hand the solution of any difficulty that may arise in the fulfillment of his office.

The first number of the series entitled "Rain" has now been written, and I herewith submit it to you with the request that it be printed. You will notice that it is written in Spanish and this for the reason that most of the observers are well acquainted with Spanish and but a few with English. When occasion offers the series may be translated into English.

The proposal is to publish the series in pamphlet form, so that those observers who have difficulty in but one set of observations need not be supplied with the whole series of instructions, which would form a book.

Being in pamphlet form I think that the cost of printing of this first part will be covered by the ordinary printing requisition.

Yours, very sincerely,

JOSÉ ALGUÉ,

Director of Philippine Weather Bureau.

The Hon. LUKE E. WRIGHT,

Acting Secretary of the Interior.

7. An article about the climate of the Philippine Islands has been prepared for publication in the census of the Philippines. It consists of an account of the climatological features of the islands and of a compilation of the most recent meteorological data, together with some practical conclusions from such data. It is probable that this account will be also published in a pamphlet form. I prepared this article at the request of General Sanger, according to the following letter:

DEPARTMENT OF PUBLIC INSTRUCTION,
PHILIPPINE CENSUS BUREAU,
Manila, January 16, 1903.

DEAR FATHER ALGUÉ: As I have stated to you, I am desirous that the forthcoming census report shall be as fully as possible a compendium of information, physical as well as statistical, concerning the Philippine Islands.

With this view, I should be very glad if you would prepare for this report a chapter upon the climates of the islands.

Lying, as they do, in the border region between the monsoons of the Indian Ocean and the trade winds of the Pacific, both systems of winds shifting with the seasons and both modified greatly in their effects by the mountainous character of the islands, producing violent alternations of rainfall and winds and modifications of temperature, the problems of climate here are among the most complicated and at the same time the most beautiful upon earth.

There is no one who has given this subject the study which you have and is so competent to treat it. Such a chapter might comprise twenty-five printed quarto pages with, besides the text, monthly and annual statistics of pressure, mean, monthly, and annual temperatures, minimum and maximum temperatures, monthly and annual rainfall, relative humidity, and monthly wind directions for the several stations of the weather service.

I would ask you also to treat the subject of earthquakes, but I see that the ground has been covered admirably by Doctor Masó, of your office, in a published pamphlet.

Very respectfully,

J. P. SANGER,

Chief Philippine Census Bureau.

Rev. JOSÉ ALGUÉ, S. J.,

Observatory, Manila, P. I.

8. A very exhaustive article, or pamphlet, has also been prepared by Rev. Father Miguel Saderra Masó, S. J., about the seismicity in the Philippine Islands, at the request of General Sanger, director of the Philippine census bureau.

9. A pamphlet containing instructions for our Philippine observers is ready for the press.

10. Finally, a new English edition of my work, "Baguios ó Ciclones Filipinos," is ready for publication.

I beg to add a few words about the cooperation of this bureau with the World's Fair at St. Louis.

THE OBSERVATORY AND THE WORLD'S FAIR AT ST. LOUIS.

Following are the documents relative to the cooperation of this bureau with the World's Fair at St. Louis:

DEPARTMENT OF THE INTERIOR,
Manila, October 24, 1902.

SIR: I beg to inform you that Doctor Niederlein, who has charge of preparing the Philippine exhibit for the coming exposition at St. Louis, has arrived in these islands, and that I shall hold a series of conferences at my office with him and with the heads of the several bureaus of this department with a view to determining at an early date upon a definite policy as to the exhibit to be made by each bureau. You are requested to give early consideration to the question of the exhibit which in your judgment would be the best that your bureau could make, in order that you may have some definite information and suggestions for Doctor Niederlein, who has himself already perfected quite elaborate plans for the several exhibits.

Notification will be sent you at a later date as to the exact time when a conference with you will be arranged.

Very respectfully,

DEAN C. WORCESTER,
Secretary of the Interior.

DIRECTOR OF WEATHER BUREAU,
Manila, P. I.

About the end of October a conference was held in the secretary's office with Doctor Niederlein to whom I proposed the general outlines of the cooperation of our bureau with the World's Fair and proposed to prepare an elaborate plan of our exhibit. In the meanwhile we prepared a large relief map of the Manila Bay and of the volcanoes Taal and Mayon, showing as a scale the mean height of clouds in Manila relatively to the height of the Mayon volcano. The large map of the Manila Bay was ready on the 20th of February, 1903, and was exhibited at the opening of the permanent museum in Manila on February 22.

About the end of March the plan of our exhibit was completed and it was proposed to the exhibition board. Everything was approved by the board and a contract between myself and the board, approved by Governor Taft, was signed by two members of the board, Dr. Gustavo Niederlein, Pedro Paterno, and myself, on April 11, 1903.

H. WORK OF THE MECHANICS.

Owing to the climate, a great amount of patient work is required to keep the delicate instruments in good running order. In the Manila observatory there were in operation at the end of August, 1903:

In the astronomical department: Two sidereal-time clocks, one with electric contacts to run the chronograph; four mean-time clocks, two with electric contacts; one 19-inch telescope, with two spectrographs and photographic camera; two 3-inch telescopes for sun-spot work; one meridian circle and transit instrument for time work; one photographic reflecting zenith telescope; one chronograph; two sets of phototheodolites; one thermograph for correction of astronomical observations for refraction; one microseismograph to register vibration of the equatorial pier.

In the open-air stations: Six instruments for direct observations; six self-registering instruments.

In the magnetic department: One complete set of self-registering photographic instruments; one thermograph to correct the magnetic observations for temperature; eight instruments for direct observations.

In the seismic department: Five instruments for direct observations; eight self-registering instruments.

In the meteorological department: Thirteen instruments for direct observations; thirteen self-registering instruments.

This makes a total of thirty-nine instruments for direct observations and thirty-four self-registering instruments, all in actual operation.

Besides the work of the mechanics in preserving many instruments in proper condition for work, they prepared, checked, and packed all the instruments sent to branch stations. They repaired many instruments from the observatory and from branch stations, some belonging to the army, navy, or civilian officials, and others belonging to private persons. More than fifty aneroids and some mercurial barometers have been repaired and rated by the mechanics since the time of my last report.

I. WORK IN THE ASTRONOMICAL DEPARTMENT.

1. The standard time, viz, time of the one hundred and twentieth meridian east of Greenwich, is given every day by telegraph from the observatory to all telegraph offices throughout the Archipelago, to the vessels in the bay, with the time ball at noon.

2. One eclipse has been observed, on March 28, 1903.

3. Regular observations of solar activity are carried on in this department, and drawings of sun spots regularly made when possible, in connection with magnetic observations, and chiefly with magnetic disturbances.

4. The most important work in this department is the rating of the chronometers. Transits of stars are regularly observed in the transit-instrument room for the purpose of rating the standard pendulum and the chronometers.

Number of chronometers rated since my last report, 39.

To give some account of the work and fidelity of some of the employees, I give here the correspondence which took place between the secretary of the Philippine civil service board and myself:

PHILIPPINE CIVIL SERVICE BOARD,
Manila, June 29, 1903.

To heads of bureau and offices:

You are requested, by direction of the Philippine Commission, to forward to this Office a statement showing the necessary qualifications for the position of chief clerk in your bureau or office, and outlining in detail the various duties devolving upon the occupant. A statement is also desired showing the name of the present incumbent, his qualifications, application to duty, average number of hours' work per week, and efficiency in performing the work required of him.

This information is needed in connection with the pending appropriation bill, and should be forwarded to this Office with the least practicable delay.

Very respectfully,

JOHN E. ENRIGHT,
Acting Secretary.

DEPARTMENT OF THE INTERIOR,
PHILIPPINE WEATHER BUREAU,
Manila, July 6, 1903.

SIR: In reply to your circular letter of June 29, I beg to state that properly speaking there is no chief clerk in this office, as there are three employees having the same annual salary, \$900, whom we may consider as chief clerks of the three principal departments in this bureau, viz, Alejandro Anareta, chief clerk of the meteorological department, Cesario Dulueña, chief clerk of the magnetic department, and Cesario Jovellanos, chief clerk in the astronomical department.

Cesario Jovellanos, chief clerk in the astronomical department, has served very faithfully in this observatory since the year 1882. His duties as such are, at present—

First, Observe celestial bodies either during the day or at night with the meridian circle and transit instrument to keep exact time.

Second. To prepare astronomical data for every calendar year to be distributed among different institutions in the islands.

Third. To rate chronometers either for the navy or for private sailors.

Fourth. To send the time by telegraph every day at 11 a. m. to navy stations and different ports of the Archipelago.

Fifth. To hoist and drop the time ball at noon.

Sixth. To make some meteorological observations in the open-air station on the observatory grounds.

The duties of Cesario Dulueña, chief clerk in the magnetic department, are—

First. To make absolute magnetic observations once a month.

Second. To observe variation instruments every hour of the working days from 8 a. m. to 5 p. m.

Third. To prepare every day photographic paper for a continuous record of the variation instruments and develop the same.

Fourth. To keep and discuss all the magnetic observations, and record and prepare them for publication.

The duties of Alejandro Anareta, chief clerk of the meteorological department, are:

First. To prepare all the data available for publication, either in the bulletins or in the reports.

Second. To observe and compare meteorological instruments brought to the observatory.

Third. To report about motion of clouds chiefly when the weather is threatening.

Fourth. To make hourly observations every fourth day.

Cesario Dulueña is serving in the observatory since the year 1891, and Alejandro Anareta since 1893.

Respectfully,

JOSÉ ALGUÉ,

Director of Philippine Weather Bureau.

MR. JOHN E. ENRIGHT,

Acting Secretary of the Philippine Civil Service Board.

An important event occurred in this department at the beginning of the calendar year 1903.

By the direction of the commanding general of the Division in the Philippines, G. W. Davis, U. S. Army, the chief ordnance officer, addressed to me in a conference some questions about the firing of the gun at noon at Fort Santiago, viz: 1. If the observatory had any particular interest in the continuance of such a signal? 2. When the signal began to be in use? 3. By whom this signal was ordered, and for what peculiar purpose?

My answer was that the observatory had no particular interest in the continuance of such signal, and that it was rather an additional work to it which was carried on since the year 1880 at the request of the commercial houses and institutions at Manila through the civil government, who settled that the artillery corps be in charge of the firing of the gun which was fired before in the part of the walls called Pastel, and after the American occupation the military authorities ordered that the gun be fired at Fort Santiago, for which purpose a special wire was laid down by the signal corps, United States Army, at the request of the chief of ordnance. As the result of this conference the following letters were written:

HEADQUARTERS DIVISION OF THE PHILIPPINES,

Manila, P. I., January 2, 1903.

SIR: The division commander directs me to inclose herewith a copy of letter from the governor of the Philippine Islands suggesting the discontinuance of the firing of the noon gun, Fort Santiago.

In compliance with the suggestion, the noon gun will no longer be fired.

Very respectfully,

G. LANGHORNE,

Captain Eleventh Cavalry, Aid-de-camp, A. A. A. G.

Father ALGUÉ, *Manila Observatory.*

THE GOVERNMENT OF THE PHILIPPINE ISLANDS,
EXECUTIVE BUREAU,
Manila, December 29, 1902.

GENERAL: In the matter of the constabulary taking over the firing of the noon gun, which is brought up by your indorsement of the 8th instant upon a communication from the chief ordnance officer, dated December 6, I would suggest that unless a military necessity requires its continuance the signal might be discontinued in as much as it does not seem to be demanded by this service or commerce. A steam whistle will be installed at the ice plant, and it is suggested might well be used, if necessary, to announce the noon hour.

Very respectfully,

WM. H. TAFT,
Civil Governor.

A true copy:

G. LANGHORNE,
Captain Eleventh Cavalry, Aid-de-camp, A. A. A. G.

The work in the magnetic department is described in the following original report of Rev. Miguel Saderra Masó, S. J., assistant director:

J. WORK IN THE MAGNETIC DEPARTMENT.

In closing my report for last year I called attention to the disturbing influence exercised upon our magnetic instruments by the neighboring stables of the civil-service corral with their roofs of galvanized iron and the workshops necessary for the shoeing of the animals and repairing of the wagons, and also by the wires carrying the current for the electric arc lights. The effect of the latter is insignificant; the perturbation is of short duration and constant character and therefore easily eliminated in the reductions. But the disturbing influence of the stables and their accessories is such as makes it at present impossible to obtain the true absolute values of the different magnetic elements within the magnetic pavilion. In order to make the monthly determination of these values, which serve to ascertain the base line of the variation apparatus feasible, it was consequently necessary to find another place, exempt from disturbing influences. This delicate piece of work required an extended and laborious series of observations and was accomplished in the following manner:

The first step was to select two spots which to all appearances were free from extraneous magnetic influences and as close to the magnetic observatory as we could find them. One was discovered to the eastsoutheast toward Singalong; the other, somewhat nearer, to the east of the exposition grounds and eastnortheast of the magnetic department.

After many days of simultaneous observations at the two stations just mentioned, in the magnetic pavilion and on a new pillar erected on our grounds west of the magnetic department and at about equal distances from the obnoxious stables and the various buildings of the astronomical and meteorological observatories, the following facts were established:

I. In the old pavilion the constant error of the east magnetic declination resulting from the influence of the stables amounts at present to $4^{\circ} 30''$ over the true value.

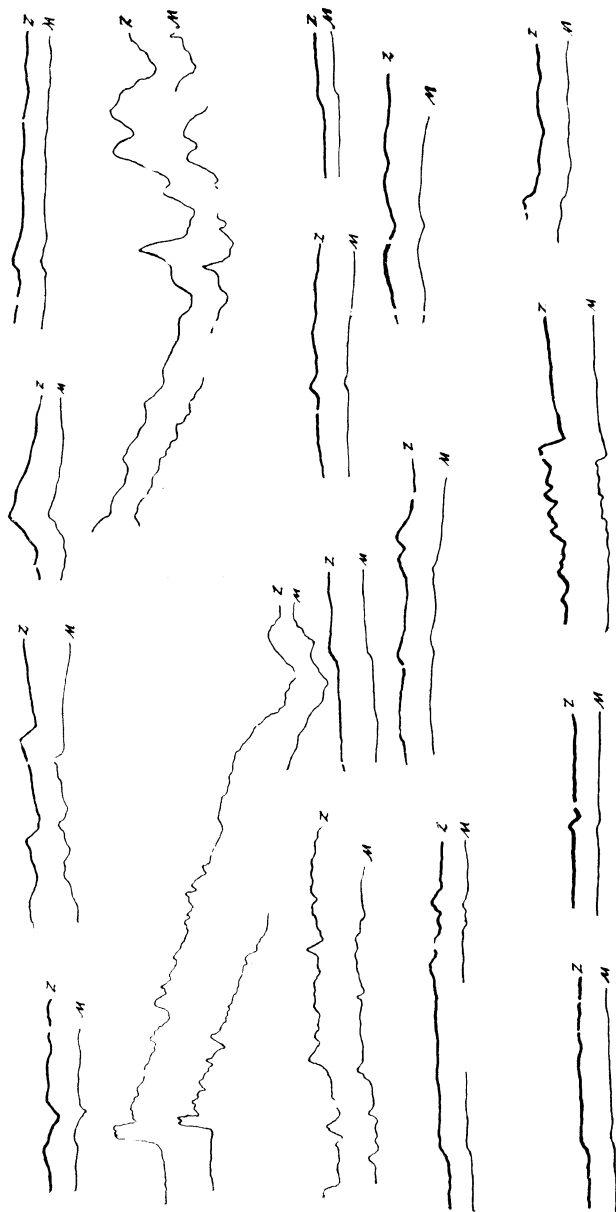
II. The new pillar to the west seems to lie outside the sphere of influence of the stables, for the absolute values obtained on it were invariably in good agreement with those ascertained at the two above-mentioned stations outside the observatory grounds or at other points which appeared to be free from disturbing influences.

III. Only in the absolute value of the declination is the influence of the stables greatly felt, for it is but small for the horizontal force and the dip. Nevertheless, also, the latter measurements are made on the new pillar to make sure of their accuracy.

IV. The stables do not seem to affect the free oscillation of the variation instruments. They produce, however, especially on the declinometer, an abnormal but constant deviation. Still, though the magnets seem to move freely, the indications of these instruments do not inspire great confidence, seeing that a source of disturbing energy is in so close proximity to the apparatus. Moreover, it is very embarrassing not to be able to make these absolute measurements in the structure erected precisely for this purpose. Similar circumstances were in recent years deemed sufficient to transfer to more favorable surroundings the magnetic observatories of Greenwich and Parc St. Maur (France).

The observations necessary to determine above facts formed the principal and most delicate part of the extraordinary work of this department during the last months of 1902 and the first months of 1903. During the months April to July the hourly magnetic observations for the year 1902 were calculated and tabulated, and they are

Magnetograms of Zi-ka-wei and Manila.



now in the press. These reductions, the current observations, the fortnightly determinations of the absolute values of the magnetic elements, and short reports of magnetic perturbations during each month published in the respective weather bulletins formed the routine work of this department for the fiscal year 1902-3.

Moreover, we determined the days of magnetic calms during each month and sent the result regularly to the internacional meteorological committee, which publishes them trimonthly.

Since March the voluminous tables of the magnetic elements necessary for cooperation in the English and German antarctic expeditions have been calculated and arranged. This plan calls for forty-eight hourly observations on the 1st and 15th of each month from the 1st of February, 1902, to the 15th of February, 1903. This whole amount of work represents, however, only a portion of the programme referred to; for, as has been pointed out at the end of the report for 1901-2, we found it impossible to carry it out as requested. The work as planned by the J. M. commission necessitated some modifications to be made in the self-registering instruments, which, after many trials, we found it impossible to have performed at Manila; and as already a considerable time had elapsed when we received the communication through official channels at Washington, there was not enough of it left to order said changes of instruments to be made in Europe or America.

A series of comparisons were also made between this observatory and that of the Zi-ka-wei, for the purpose of investigating the simultaneity of the sudden movements of the magnets during magnetic disturbances and the similarity which these movements might possibly have. These studies have revealed the fact that in almost all the disturbances of any importance the movements of magnets, especially that of the Bi-filar, are identical and simultaneous at Manila ($120^{\circ} 58' 33''$ E. of Greenwich and $14^{\circ} 34' 41''$ N. lat.) and Zi-ka-wei ($121^{\circ} 29'$ E. and $31^{\circ} 11' 33''$ N.). The simultaneity is such that the differences of time of occurrence oscillate between ten and twenty seconds, a quantity much smaller than the error which may be introduced into the observations either by the imperfections of the clocks operating the self-registering instruments or as a consequence of the great difficulty of estimating seconds on the photographic record. The mean difference of duration was found to be less than five seconds.

To show the similarity of the movements, I have the honor to present on the accompanying plate some of the corresponding curves traced by the Bi-filars of Manila and Zi-ka-wei. For the curves of the latter place we are indebted to the kindness of Rev. Fr. F. Moidrey, director of the Magnetic Observatory of Zi-ka-wei (Shanghai).

The two sets of curves—those obtained at Zi-ka-wei being the upper, those of Manila the lower of each pair—are distinguished by means of the letters Z and M, respectively. Both are reproduced in natural size, the evident difference being due chiefly to differences of the instruments. The Zi-ka-wei apparatus is of the Kew pattern, and has greater velocity than the instrument at Manila (Mascart type), 15.5 mm. of paper passing before the magnet every hour in the former, and only 10 mm. in the latter. The magnification is also slightly greater in the Zi-ka-wei recorder than in that of Manila.

The evident conformity of movements between our instruments and those of Zi-ka-wei further corroborates the statement made above that the stables, etc., do not impede the free oscillation of the variation magnets, though, as stated, it causes a constant abnormal deviation from their base line. This fact has also been noticed in other parts of the world.

(Signed)

MIGUEL SADERRA MASO, S. J.

It is to be feared that within a few years it will become necessary to transfer elsewhere the magnetic instruments of variation, as the action of electric currents of variable strength and power for electric traction will render their indications almost useless. Fortunately it is a quite general opinion at present that after ten years of continuous record of magnetic variations in one place a perfect knowledge of the magnetic conditions there may be derived. Then, if the petition for the concession of a piece of land in Baguio (Benguet) to the observatory is granted, the magnetographs may be successfully mounted there for a series of years.

IMPORTANT DECISIONS.

PHILIPPINE WEATHER BUREAU,
Manila Observatory, January 26, 1903.

SIR: In view of the fact of the importance of experience in the work of the weather bureau, and for the greater encouragement of observers who begin with small salaries to remain persevering in the service in the hope of being promoted to higher duties which bring greater compensation, we deemed it well to propose to the civil service board that the director of the bureau be authorized to promote such observers, calculators, assistant observers, assistant calculators who have been more than four years in the service to higher ranks without the necessity of competitive or any other examination for said promotions. This method, we believe, would secure trained and experienced observers.

Respectfully,

JOSÉ ALGUÉ,
Director of Philippine Weather Bureau.

Mr. W. S. WASHBURN,
Chairman of the Civil Service Board.

PHILIPPINE CIVIL SERVICE BOARD,
Manila, January 28, 1903.

SIR: The board acknowledges receipt of your communication of January 26, in which you state:

"In view of the fact of the importance of experience in the work of the weather bureau, and for the greater encouragement of observers who begin with small salaries to remain persevering in the service in the hope of being promoted to higher duties which bring greater compensation, we deemed it well to propose to the civil service board that the director of the bureau be authorized to promote such observers, calculators, assistant observers, assistant calculators who have been more than four years in the service to higher ranks without the necessity of competitive or any other examination for said promotions. This method, we believe, would secure trained and experienced observers."

In view of the character of these positions, and the difficulty of holding examinations outside of Manila for promotion in these cases, the board will not require promotion examinations after four years' service, provided that it is not proposed to promote to a position compensated above \$900 per annum.

Very respectfully,

W. S. WASHBURN, *Chairman.*

THE DIRECTOR OF THE PHILIPPINE WEATHER BUREAU,
Manila, P. I.

Another very important improvement has been introduced in the bureau with the resolution of the Commission passed with the act 807, which reads as follows:

Provided, That in the discretion and upon authorization by the director of the weather bureau any third-class observer may engage in private business or accept employment from another branch of the insular or Federal government and receive compensation therefor, anything in existing laws prohibiting the payment of extra compensation to government employees to the contrary notwithstanding: And provided further, That such additional government employment shall be entered upon only after arrangement therefor shall have been mutually agreed upon between the director of the Philippine weather bureau and the head of the other bureau or office concerned.

Another decision which will have the utmost importance in making the work of the weather bureau more effective and useful is act No. 840, which was passed by the Commission on August 24, 1903.

The act reads as follows:

Provided, That if, as the work of establishing stations progresses, the director shall find that in some instances places other than those named in this section are better suited to the requirements of the weather service, he is authorized to change the location of stations in his discretion.

Enacted, August 24, 1903."

Respectfully,

JOSÉ ALGUÉ,
Director of Philippine Weather Bureau.

Hon. DEAN C. WORCESTER,
Secretary of the Interior.

APPENDIX K.

SECOND ANNUAL REPORT OF THE CHIEF OF THE ETHNOLOGICAL SURVEY FOR THE PHILIPPINE ISLANDS (FORMERLY THE BUREAU OF NONCHRISTIAN TRIBES).

DEPARTMENT OF THE INTERIOR,
THE ETHNOLOGICAL SURVEY FOR THE PHILIPPINE ISLANDS,
Manila, September 15, 1903.

SIR: I have the honor to submit the second annual report of the ethnological survey of the Philippine Islands.

The Philippines have long passed current in Europe as a very imperfectly explored Archipelago. I believe that this is less true than is ordinarily supposed and stated. It is manifestly true that little satisfactory information has been given to the world of the physiographic features or of living forms of the extensive and broken interiors of the great islands of the group, or of the wild tribes which inhabit these mountains and forests, but it is a mistake to infer from this that there are large unexplored areas which no white man has crossed and savage tribes which no white man has seen.

During the last fifty years of Spanish rule the soldier and the missionary were both active in extending the dominion of state and church, and, though their arduous efforts among pagan and Moham-medan tribes have produced few submissive subjects or proselytes, they did serve to make known to some extent that great portion of the Archipelago which had lain almost undisturbed by European intruders since the arrival of Legaspi. On the other hand, the territory and peoples actually converted to Christianity were practically marked out by the first few years of Spanish conquest, and have had few additions since the close of the sixteenth century.

Legaspi landed on Cebu in May, 1565. Within ten years thereafter the Spaniards had discovered every island of importance, determined its relative size and consequence, and had successfully laid hold of all of the country which has since responded to civilization and conversion. The list of encomiendas prepared in 1591 (*Relación de Encomiendas in Retana: Archivo del Bibliófilo Filipino*, tomo 4) covers nearly the whole of the present christianized provinces which then had population. The Calamianes, the east coast of Luzon, the Batanes islands far north, and even such remote regions as the headwaters of the Rio Grande de Cagayan, were under Spanish encomenderos. The notable survey of the Archipelago left us by the Oidor Dr. Morga (*Sucesos de las Islas Filipinas*, 1609, 2d ed. 1890) at the opening of the seventeenth century reveals to us the surprising fact that the islands had been subdued and christianized then almost as widely as they are to-day, with the single addition of Nueva Vizcaya. The Spanish explorers and missionaries largely rested on their conquests for two

and a half centuries after the first triumphs of the pioneer period had been won. About 1800 Fray Martinez de Zúñiga wrote a brilliant descriptive account of the islands, which in recent years has been brought to light and published by W. E. Retana. (*Estadismo de las Islas Filipinas*, 2 v., 1893.) He mentions the Igorot and the Tingian tribes of northern Luzon, but the only information he had was that which had come through the trading of the Ilokano Christians and the hillsmen. The coast of Mindoro in Zúñiga's day had become almost depopulated through the incursions of the Moro pirates; Paragua had but a single Spanish settlement; and, except for the Bisaya settlements about Caraga, Butuan, and Misamis, all Mindanao and the Sulu Archipelago were independent, fiercely hostile, and sources of incessant piracy.

But the last decades of Spanish sovereignty effected great changes in the Spaniard's control over these great regions inhabited by pagan and Mohammedan tribes. As early as 1837 a Spanish expedition under an officer named Galbey, pressed up the spurs of the Cordillera Central and reached the elevated plateau region of Benguet, where the Philippine government has this year established its summer capital. This was the first effective inroad to be made upon the mountain territory of the powerful and warlike Malayan hill tribes, who are collectively known as the Igorot. From this time on Spanish progress in the Cordillera Central, though slow, never ceased, and at the close of Spanish rule, there were in the mountains of Northern Luzon no less than eleven politico-military comandancias—Benguet, Kayapa, Amburayan, Lepanto, Tiagan, Bontok, Kiangnan, Binatangan, Itaves, Apayaos, and Kabugaoan. Each of these commands was a center of Spanish authority, with its cuartel, guardia civil, mission station, and in some cases with its vaccine depot and school. Admirable pony trails were built through these mountains, coffee and cacao culture and the raising of stock were introduced, and a great deal was done to suppress the terrible feuds that wage between these wild communities and keep the population of whole regions in a constant state of panic and apprehension.

Meanwhile in the south the tide turned at last in favor of Spanish arms. The introduction of steam gunboats about 1845 permitted the Spaniard to take the aggressive against the Moro. The last haunts of piracy, the islands of Tonquil and Balanguingui, were overcome about 1848, and from that time Spanish efforts were devoted to subduing and occupying the mainland of Mindanao and the Sulu Archipelago. Very important results were achieved by General Weyler between 1886 and 1891, and at the end of the Spanish period, forts, block-houses, and trochas lined the coast of Mindanao and dotted the map of the Sulu Archipelago. Spain abandoned all of these frontier outposts early in the Philippine insurrection. For two years following American occupation, our attention and effort were directed toward subduing and reorganizing the christianized provinces, and the result was that at the end of the insurrection and with the inauguration of civil government, two years ago, the government found itself not only very imperfectly in control of four-sevenths of the archipelago, but without adequate knowledge of these regions or their inhabitants.

The bureau of non-Christian tribes, now the ethnological survey, was organized in October, 1901, primarily for the reexploration of these little-known parts of the islands and securing such information

relative to both country and peoples as a government should properly possess about even the wildest and least accessible portions of its jurisdictions. The initial work of this survey is now nearly complete. By the end of the present year I hope to be able to report that a preliminary exploration of all portions of the Archipelago has been finished; that the field parties of this bureau will have explored every region of the islands, visited every non-Christian tribe, and secured the geographical and ethnological data necessary to complete our knowledge of the Archipelago.

Within the last two years civil governments have been established over nearly all of the territory embraced in this discussion. The operations of the army in central Mindanao have broken the only aggressive opposition of the Moros, and the work of many people, both official and private, in all parts of the Archipelago, has contributed to increase our knowledge of those parts of the islands previously unknown to Americans. In making this survey the bureau has been assisted by the continually widening occupation of the islands and by the exploration of private individuals, either prospecting for gold or searching for adventure.

The first task of this bureau, then, has been to secure definite information relative to the geographic character of the wilder and less known portions of the Archipelago and the tribes of these regions, both by recovering such information as was secured under the Spanish Government and by new explorations. The necessity felt for completing in as brief a time as possible this preliminary survey has kept all the workers of this bureau almost continually in the field and has given so far little opportunity to prepare for publication the scientific results secured. The territory occupied only by non-Christian tribes embraces considerably more than half of the superficial area of the Archipelago.

The following pages describe the activities of the individual workers of the bureau.

WORK OF THE CHIEF OF THE SURVEY.

The time of the undersigned for the last year has been spent almost wholly in the field. In June, a year ago, I went to Benguet to begin an exploration of the Cordillera Central. In July and August a trip was made, under instructions from the secretary of the interior, to quarantine the mountain tribes against cholera. This trip was northward through western Benguet, and thence into the rough, mountainous country of Amburayan, inhabited by Kankanay Igorot, where the river was followed out to the coast, and a new sketch map of this little-reported region prepared. My route was then up the coast to Candon and back through Tiagan and Lepanto into Benguet.

In September a longer reconnoissance was undertaken with more ambitious aims. The party was composed of the undersigned, Dr. A. E. Jenks, Mr. Charles Martin, and Mr. Vicente Garcia, now a subinspector of Philippine constabulary. The party left the Agno River Valley at Ambuklao, and ascended the mountains into the beautiful but almost abandoned district of Kayapa. Mount Ugu, the highest peak of this southern end of the Cordillera, was ascended, and its height, as registered by aneroid barometer, was found to be 6,970 feet. Nueva Vizcaya was entered through Santa Cruz de Manga to Aritao. From Dupax a short trip was made into the mountains eastward to

visit the Ibilao, one of the most curious and puzzling of all these tribes of northern Luzon. From Nueva Vizcaya the party entered Kiangnan, where progress was made very difficult by the head-hunting feuds which divided the Igorot communities. Trophies of human heads were found in nearly every village entered. A return was made to Nueva Vizcaya, and thence we crossed the low hills that follow the course of the Magat to the valley of the Rio Grande de Cagayan. From Ilagan a short trip was made up the Rio Katalangan, and the Kalinga villages in these foothills of the Sierra Madre were visited. From Kabagan Nueva our route was back into the Cordillera Central, by way of the old Comandancia of Itaves and the Rio Chico. Seven days of very hard travel through these rough but wonderful mountains brought us to Bontok. On the 1st day of November we had the misfortune to provoke a fight with the Igorot of northern Bontok, which has been fully reported elsewhere, and which delayed the party in Bontok for nearly two weeks. Accompanied by the lieutenant-governor and the captain of constabulary, I made a trip back to the scene of the fighting to reestablish friendly relations with the Igorot by means of a *kañao*, or ceremonial feast. From Bontok we returned to Baguio, Benguet, by way of Cervantes, Suyok, and the Agno River Valley.

This reconnoissance revealed to us the general physiographic features of the Cordillera Central; its parallel mountain chains, its river systems all centering in Mount Data; its surprising forest growth, and especially the distribution and character of the great Igorot family of mountain tribes. Anthropometric measurements were secured, a large series of photographs taken by Mr. Martin, and brief vocabularies made of 11 dialects. My conclusions regarding these interesting and savage mountain tribes will follow.

Following the completion of this reconnoissance in December the undersigned returned to Manila for necessary work in connection with the office, but made one more trip to Benguet in the same month, going up through Pangasinan, the Bued River Valley, and neighboring mountains. This is one of the oldest routes of travel, and communication between the Igorot and the low lands of Pangasinan, and I desired to examine the character of these mountains more fully than I had previously had opportunity to do.

In January, in an interval between office duties, I made a brief trip to Mindoro, and from Calapan went up the western fork of the Baco River to a point near to its sources on the north side of Mount Halcon. On a forested spur of this great mountain I found a small village of the very primitive savages of Mindoro, the Mangyan. Information was given me here of other communities living farther and higher in the interior, but the short space of time which I could then spare from my office forbade further visits.

The immediate political importance of the southern islands and region inhabited by Mohammedan tribes determined the field of work for the undersigned during most of the months of the present year.

For work in these Moro regions, and especially with reference to the island of Jolo, Dr. N. M. Saleeby was appointed in February to the position of "assistant to the chief of bureau in charge of Moro affairs." Doctor Saleeby, while a medical officer in the United States Army, had already spent a year and a half in the Rio Grande and Lake Lanao regions. His knowledge of Arabic and his special powers of

mind had enabled him to gain an unusual understanding and command of the situation among the Moros of the Cottabato region. His appointment to the bureau was eminently fitting, and his subsequent services have been important.

Accompanied by Doctor Saleeby and Mr. Clyde Arnold as stenographer, I left Manila on March 1 on the coast-guard steamer *Tablas*, and the entire month was spent in cruising among the islands of the Sulu Archipelago and along the southern coast of Mindanao.

In April trips in native Moro boats were made along the coasts of Zamboanga, which were interrupted by a necessary trip to Manila and Benguet, where the Philippine Commission was deliberating, but were resumed in May, when the eastern coast of Zamboanga to Sibugay Bay was quite thoroughly explored and a visit paid to Dumankilas Bay farther east. On this latter trip I was accompanied by Dr. P. L. Sherman, of the bureau of government laboratories, who was collecting gutta-percha and rubber; by Mr. George Ball, government photographer, and by Mr. Walter Gerbrick, collecting for the ethnological exhibit of the bureau for the exposition board. Our party was landed at Dumankilas Bay, near the site of the former Spanish fortress of Margastubig, on June 18. Some days were spent with the Subanon who inhabit the hill country surrounding this bay, and accompanied by Mr. Gerbrick I crossed to Cumalarang and visited Datu Dakula, one of the most legitimate of the Maguindanao rulers. From Dumankilas Bay our party crossed through the hills to Dinas, where the exiled Sultan of Maguindanao is spending a year of mourning for the recent death of his son. From Dinas we sailed in a native boat to Tucuran, stopping at the Tacala islands and spending one night in the Illano Moro settlement at the mouth of the Labangan River.

In June, with the same party, I visited the island of Basilan, and from Isabela, the site of the naval station, we sailed to Lamitan and met the most extraordinary political chieftain which the Philippines have produced, Datu Kalun. The greater part of the population of this island are Yakan, who will be briefly described later on.

In July I returned from Zamboanga to Manila, and until my work was interrupted by the appointment to the position of general superintendent of education, on August 13, was busied with preparation for the press of the materials gathered in over a year's almost continuous study and travel in the field.

The results of my observations will be presented in several brief monographs: "The Tribes of the Cordillera Central of Northern Luzon;" "Notes on the Ibilao;" "Notes on the Mangyan of the Baco River, Mindoro;" "The Subanon of Western Mindanao;" "The Mohammedan Tribes of the Philippine Islands;" "A Contribution to the Classification of the Races of the Philippines." Of these the first alone is at this date ready for the press.

WORK OF DR. ALBERT E. JENKS.

On August 20, 1902, Doctor Jenks left Manila to begin his field work in these islands, and at Baguio, Benguet, joined the chief of the bureau for extensive exploration among the primitive peoples of northern Luzon. As stated above, he was one of the members of the party who, on September 24, started from Baguio on a two months' trip among the Igorot of Benguet, Nueva Vizcaya, Isabela, Cagayan,

Abra, and Lepanto-Bontok provinces. The general results of this trip have elsewhere been stated. While on this expedition he spent ten days in the vicinity of Bontok pueblo, and from visits to near-by towns became satisfied that the Bontok Igorot were as typical of the large class of primitive people in the mountains of northern Luzon as any group then visited. Several other facts pointed to Bontok as a desirable place for making an exhaustive investigation of the typical, primitive, mountain Malayan. His desire to make this intensive study met with my ready approval and Doctor Jenks returned to Manila and prepared for an extended field trip and residence in Bontok.

Mr. Charles Martin, government photographer, was detailed to go to Bontok and take such photographs as desired. Mrs. Jenks joined Doctor Jenks in Baguio, and they proceeded to Bontok by the mountain route via Ambuklao, Cabayan, Loo, Cervantes, and Segada, arriving in Bontok January 6 of this year. Mr. Martin had been detailed to remain on the field only three weeks, so all of Doctor Jenks's time during his stay in Bontok was spent with him directing and assisting in having made such negatives as would be desirable for publication to illustrate the Bontok study. Mr. Martin made in the three weeks about 300 admirable negatives. I do not hesitate to say that they are in every way superior to any set of photographs of a single group of primitive people yet published.

After Mr. Martin returned to Manila, Doctor Jenks began the systematic study of the Igorot, and also made about 100 good negatives, thus swelling our photographs of this people to a thoroughly representative collection of about 400. He remained in the province five months, or until June 1, arriving in Manila June 13 via the "lower trail" from Bontok to Cervantes, and thence to Candon, and from Candon by boat to Manila. He brought from Bontok a representative ethnological collection for exhibition at St. Louis, and voluminous notes on which he has spent most of his time since, preparing them for publication.

His monograph, to be entitled "The Bontok Igorot," will be ready for the public printer in six weeks provided the preliminary work for illustrations is completed at that time and unless his work is unduly broken into by other official duties. It will make a volume of about 70,000 words, and will be well illustrated from excellent photographs, outline maps, and sketches.

Doctor Jenks's study shows, among a wealth of detailed information, that the Igorot of the Bontok culture area, an area nearly coextensive with the old Spanish comandancia of Bontok, is probably as primitive a Malayan type as there is in Luzon. His culture is Malayan in practically every essential, and is not, as is so often said, the result of Chinese and Japanese influence. Both the social and political organization reveal conditions never before brought out in writings on Philippine tribes. One social institution, fostering a form of trial marriage, is similar to an institution far in the mountains of the Asiatic mainland, and is one of two or three hints that the original home of the primitive Malayan was much farther inland than is commonly believed. The social and political institutions as revealed by the study are such that controlling and developing legislation may be prepared which should carry the Igorot successfully forward toward American ideals.

A great deal of new and purely scientific data has been gathered,

among the most striking of which may be mentioned the discovery of a primitive currency. This currency is based on palay, the unthrashed rice. It has, in its crude way, all the essentials of modern money. Mention should also be made of the discovery of facts which suggest a new theory of the origin of clothing. It also appears that primitive man may become a metal worker, apparently unaided by modern peoples, without passing through the Stone Age. His study also revealed that there is no better place in the world than this Archipelago to study the beginnings and fundamentals in the science of mankind.

WORK OF MR. WILLIAM A. REED.

During the absences of the chief in the field the office work of the bureau has been most of the time in charge of Mr. Reed. Besides the routine business he has devoted much time to the gathering and filing of data and information from whatever source, concerning the non-Christian peoples of the Philippines, the indexing of the library collected since the organization of the bureau, and the translation from Spanish, French, and German of various extracts and articles having a direct bearing on the work of the bureau. The library at present consists of about 500 volumes, including those transferred from the library of the United States Philippine Commission, but excluding a large number of pamphlets and small paper-backed books. The books may be classified under three heads—Philippiniana, Malaysia and Polynesia, and General Ethnology—and are so grouped on the shelves of this bureau.

In the month of January of this year Mr. Reed was intrusted with the installation of a small ethnographical exhibit from the bureau at the Hanoi Exposition, Hanoi, Indo-China. This exhibit was accompanied by a leaflet in English and French explaining its object, which was to commend the work of the bureau to scientists throughout the Orient. The best results in the study of Philippine ethnology can be obtained only by a wide comparison of material from Malaysia, Polynesia, and the continent of Asia. The Hanoi Exposition, by reason of the sessions there of the International Congress of Orientalists, seemed to offer an opportunity to secure the interest and cooperation of other workers in similar fields of study. Mr. Reed states that he was given a very cordial welcome on the part of the French officials, and was accorded every assistance. The exhibit, which consisted for the most part of photographs of racial types and maps, attracted considerable attention, especially from those interested in scientific work. Mr. Reed brought back a complete report of the Congress of Orientalists, whose meetings were concerned with the reading and discussion of papers on nearly every branch of scientific and linguistic research now pursued in the Orient. He also secured several publications of value to this bureau as books of reference.

The relatively large numbers of the Negritos in the Zambales Mountains had for more than a year drawn our attention as a most promising field for the study of these famous little blacks. Mr. Reed, having given much attention during the last year and a half to the literature of the Negritos, was designated to make the initial study of these pygmies in the region above named. He left Manila on the 24th of June, accompanied by Mr. J. Diamond in the capacity of photographer, and five days later established a camp in the Negrito barrio of Tagiltit,

about 22 miles southeast of Iba. He remained three weeks studying the customs of the people and taking photographs and measurements. During this time his camp was visited by about six hundred Negritos, some coming as far as 20 miles. At the expiration of this period he started south behind the low mountain range which separates this territory from the plains, and traversed an exceedingly rough and broken country. The trail, but little used at any time, would be impassable in the rainy season, as it follows for the most part the beds of mountain streams. During two days' journey from the starting point to the barrio of Santa Fe, near the town of San Marcelino, four little rancherías of Negritos were passed. Others had been reported at Santa Fe, but Mr. Reed learned on arrival that they lived on little mountain farms in all directions and from five to ten miles away. Some of these were sent for. After a week here he pushed east toward the Pampangan boundary and visited the Negritos of Cabayan and Aglao. These were all of the class called by the Spaniards "conquistados," but they said that farther in were people who still continued their depredations on the people of the lowlands, and whose territory they themselves no longer dared to enter.

After a week or so at these places he returned to San Marcelino and proceeded to Subig and Olongapo. Near each of these towns are barrios of Negritos of a type somewhat different from those of the north, being generally larger, more robust, and muscular. There is also a difference in facial features, but the measurements taken have not yet been compared. All through this region there may be found Negritos of mixed blood living with those of apparently pure type. Perhaps the chief cause of this Malayan mixture is the fact that criminals from the Christianized pueblos escape to the mountains and take up their abode with the Negritos. There is no evidence that such intrusions of the Malay have in any way elevated the culture plane of the Negrito. On the contrary, the new comer readily adopts the customs and habits of his protectors and becomes one of them.

In the matter of culture the Negritos of Zambales have reached a high point in the bow-and-arrow stage. These arms are by far the most perfect so far seen in the Philippines, the arrows being well feathered and provided with well-made iron points of different shapes for different purposes. The Negritos still subsist largely upon the fruits of the chase, and are cunning and tireless hunters. But with the advent of homes more or less fixed comes the agricultural life, and they raise many vegetables, some corn and tobacco, and a little mountain palay. The work of planting and cultivating is largely done by women and children. They are also more or less continually engaged in trade with the people of the lowlands whereby they exchange bejuco, beeswax, and other mountain products for cloth, rice, salt, bolos, and iron for arrow points; but not having any idea of values, they are systematically fleeced by the unscrupulous Filipinos.

The Negritos are almost entirely without skill in making things, except their weapons and traps, and in fact make nothing else worthy of notice. Their time is chiefly taken up with the quest for food, and the problem of getting enough is really a serious one. They have many interesting customs, are great lovers of music, and perform extremely well a variety of character dances in which they mimic certain animals and people doing certain things. All the information and data collected is being arranged for publication. Although the

study has been by no means exhaustive and could not be in the limited time given it, yet enough has been learned to form a preliminary study of value to future workers among the Negritos in other parts of the archipelago. It will make a book of about 15,000 words and will be accompanied by photographs and drawings.

From July 24 to September 6 Mr. Reed was occupied in a rapid survey of the province of Occidental Negros, the chief object of the trip being to ascertain the character and location of the mountain tribes of that province and to appoint enumerators for the Philippine census. During this period he made three expeditions into the mountains and visited several rancherias of the so-called "Monteses," which are classified by us under the comprehensive term "Bukidnon." He reports that these primitive people are, in his estimation, of the same race as the Christian people of the coast, although differentiated somewhat by reason of isolation and environment in dialect and physical features. They occupy more or less the entire mountainous region from Mount Maripari, due east of Bacolod, to the extreme southern end of the island. They are not numerous, however, except from the mountains of La Castellana to Cabancalan. This territory is not so broken and inaccessible as the mountains of the extreme north and is full of the small rancherias and scattered houses of the Bukidnon, who devote themselves chiefly to the growing of small crops of corn, palay, and vegetables. Sometimes, as in the rich Carulan Valley, they are more advanced in civilization, own carabao, and grow tobacco, coconuts, and cacao. They are, as a rule, peaceable, though they have at times allied themselves with the insurgent "Babaylanes" operating throughout this region.

The people of the vast unexplored region, as the Llanuras de Tablas, are of the same type, though perhaps a little wilder and not so far advanced in culture. This region is not so thickly inhabited as that immediately north. There are probably 15,000 Bukidnon in the entire province.

In addition, in the high, almost inaccessible mountains of the north live a few scattered families of Negritos. Two sitios are known, each of which contains as many as twenty families, but for the most part they live a wandering life. Formerly they came down into the coast towns to trade and beg, but military and constabulary expeditions into their domain have so filled them with dread of the white man that they no longer show themselves in the coast towns. The number of Negritos is estimated to be not more than 1,500. Mr. Reed states that from his examination of a Negrito captured by the constabulary he could get no trace of an original dialect, but he was told by old residents that they had one.

A great deal of information of a general nature regarding the industrial life of the Bukidnon and a little of their particular customs and beliefs was gathered during these expeditions and several photographs and some ethnographical material were secured by Mr. Reed's trip. His investigations will probably appear in a brief monograph on the Bukidnon of Occidental Negros.

WORK OF DR. NAJEEB M. SALEEBY.

As above stated, Doctor Saleeby was appointed to the position of assistant chief of this bureau February 1, 1903. Doctor Saleeby

brought with him from Mindanao a collection of 23 original documents pertaining to the law, history, and religion of the Magindanao Moros, which were purchased by this bureau, and which will be edited and published with translations.

In order to reduce these writings from Arabic to Roman characters, Dr. Saleeby discovered that his first need in this work was the adoption of a system of transliteration which could be used in transcribing all languages of the Philippines. Doctor Saleeby gave this subject very close study for a month and the result was the preparation of a monograph which has since been freely circulated in manuscript form for criticism among linguistic scholars in these islands. The Spanish system is manifestly inadequate even for the correct writing of the languages of the Christianized and more or less "Spanishized" Filipinos. This fact has led to the use of a variety of diacritical signs to indicate the different sounds found in these tongues. There has been no general agreement among Philippine writers, and it is the hope that a system can be adopted by this bureau which will meet with general acceptance.

As it has been stated above, Doctor Saleeby sailed with the chief of bureau on March 1 for Mindanao and Sulu. At the expiration of a month's cruising he established a permanent station on Jolo, which was to him a new field. He very quickly, however, won an influence over a number of influential Arab merchants and proselyters on the island of Jolo, which led him at once to acquire an accurate knowledge of the numerous intrigues which surround the Sultanate of Sulu.

Doctor Saleeby made a trip in May to Benguet at the desire of the governor to advise the Commission upon the bill for the government of the Moro Province, and with the exception of this absence has spent his time largely at Jolo, where he was of assistance to the military authorities as an independent and reliable source of information, and where he has devoted his time to the study of the Sulu language, and the preparation of other material bearing upon the Moros. My latest advice from him is that he has nearly completed a monograph upon the history of the Moros of Magindanao, written from the Moro standpoint, and from their own historical documents, as well as translations of several of the Moro codes of law.

WORK OF DOCTORS MILLER AND FOLKMAR.

By arrangement with the exposition board this bureau has had the services of two admirably equipped men, both of them doctors of philosophy in anthropology, in preparing the ethnological exhibit for the Louisiana Purchase Exposition. These gentlemen, Mr. Merton L. Miller and Mr. Daniel Folkmar, were engaged in the United States, and began work under my direction about the middle of June.

In July Doctor Miller, accompanied by Mr. Martin, the government photographer, made a trip to the interior of Mindoro with the primary object of forming an ethnographic collection from the Mangyan. They accompanied the expedition of Governor Offley, crossing the interior of Mindoro from Sablayan to the east coast. The results of this, the first crossing of Mindoro, were, however, from the ethnological standpoint somewhat disappointing. The interior of the island appears to be a waste of forest and jungle. Very few of the primitive Mangyan were encountered in the interior, and the general conclusion would seem to be that the greater part of this island has never been inhabited.

Subsequent to this crossing, Doctor Miller and Mr. Martin went south to Bulalacao, in the vicinity of which town the Mangyan are most numerous, but here Doctor Miller's work was interrupted by a severe attack of malarial fever, from which he was still suffering upon his return to Manila.

In August Doctor Miller went south to Surigao to explore the peninsula of Surigao and to study the Negrito inhabitants, the Mamanua, and for the ascent and exploration of the Agusan River, where he will encounter the Manabo and Mandaya. From this trip Doctor Miller has not yet returned.

Doctor Folkmar has been continuously occupied with physical anthropometry in Bilibid prison. He has measured a series of about 800 men from all the Christianized Filipino tribes, and has taken four photographs each of about 400. In addition to this he has prepared a very interesting series of casts of faces and busts. The results of his work will for the first time place us in possession of an adequate body of anthropometrical data upon the typical tribes of these islands, which will go far toward solving the general problems of the origin and affiliations of this race.

The work of the other employees of this bureau, Mr. Samuel B. Shiley and Mr. Richard C. MacGregor, do not properly fall within the scope of an ethnological report, and has been elsewhere described in a report upon the Philippine Museum.

Of the work of the temporary employees performed under my direction, mention should be made of Mr. Moray L. Applegate, who, in February, accompanied a party to Paragua and made some exploration of the tribes living along the southern coasts of that island. On the return of the party, he was left at the northern end of the island, and made his way southward through the territory of the Battak and Tagbana to Puerto Princesa.

In the same month Mr. E. J. Cooke made a trip to Bataan which resulted in new information in regard to the Negritos of Mount Mariveles, and Mr. E. J. Simons made a collecting trip into the mountains of Bulucan which added considerably to our knowledge of the homes of the Negritos of that province. Mr. Orville V. Wood has collected in the Gulf of Davao and has furnished from time to time information concerning the tribes of that region.

Of the valuable contributions to our knowledge of the tribes of these islands, made by volunteer workers from time to time during the year, many of them by Filipino gentlemen whose excellent reports reveal an aptitude for this class of scientific investigation, the following may be mentioned as especially worthy: "The Ifugaos," by Señor Wenceslao Valera, Bayombong, N. V.; "The Buquidnones of Oriental Negros," by Señor Santiago Gonzales; "The Negritos of Cagayan," by Señor Pedro Daña; "Manguianes," by Señor Servulo Leuterio, Calapan, Mindoro; "Negritos of Bataan," by Señor Vicente Rodriguez; "Tinguianes," by Señor Emeteru Molina, Dolores, Abra.

In addition to its files of data, the bureau has made this year a collection of 1,100 original photographs from different non-Christian tribes of the Archipelago, none of which have as yet appeared in publications. This work was largely done through the cooperation of the bureau of government laboratories, which supplied an official photographer for many of this bureau's expeditions.

SUMMARY DESCRIPTION OF THE PAGAN TRIBES.

THE NEGRITOS.

Any discussion of the tribes of the Philippines properly begins with these little blacks. The problems connected with their origin were suggested a year ago, and it can not be said that we are nearer a solution to-day. They appear to me to constitute one of the most puzzling problems presented by any of the races of the world. To connect them with the Melanesian of New Guinea, as was done fifty years ago by George Windsor Earle (*Earle's Papuans*, London, 1853), is to disregard principles that are recognized as fundamental in the classification of races. The Melanesian are tall, dolichocephalic, prognathic. The Negritos are very short, round headed, flat nosed, with undeveloped jaw. The only resemblance between the two races are their common dark color and more or less crinkly hair.

That the Negritos were more numerous and more independent at the time of the arrival of the Spaniards can be demonstrated by historical accounts, but the amalgamation of the culture and language of Negrito and primitive Malayan it seems must have long preceded the arrival of the European. Repeated efforts have been made by this bureau to secure from Negritos in different parts of Luzon vocabularies unaffected by Malayan influence, but everywhere we have found that the current speech of these little blacks is very largely that of the neighboring Malayan tribe. Occasionally words may be secured which stand out uncouth and strange among the Malayan roots and which may be the survivors of the peculiar original language of these Negritos.

While the Negrito has borrowed little except language from the Malayan, he has apparently taught to the Malayan, in some instances, his own intimate knowledge of the forest and jungle products and the use of the bow and arrow, which, wherever found in the Philippines, can almost invariably be traced to Negrito derivation. The bow does not seem to have been the original weapon of the Malayan, who has made use of the spear, knife, and the blow gun.

THE IGOROT.

As stated above, I use this term here to designate the great stock of primitive Malayan tribes occupying the Cordillera Central of northern Luzon.

By differences more or less pronounced in their dialects, as well as interesting but unessential variations in custom, the Igorot are divided into the following branches or tribes: Ibaloi, Kankanay, Isinay, Siliapan, Mayoyao, Bummayon, Kalinga, Gaddang, Dadayag, Ginaan, Ipokao, and Apoyao.

These terms, while not in every case satisfactory, have been selected after diligent inquiry among the Igorot themselves, and they are designations which would be understood if spoken in the localities where they occur.

A comparison of Igorot dialects shows that they are all closely related to one common Malayan speech of an early period. Unlike the dialects of the primitive Malayan tribes of Mindanao, as well as the Christian and Mohammedan tribes, these Igorot dialects do not appear to contain a Sanscrit element, except where this has entered through recent borrowings from the Ilokano and Pangasinan.

We have here, then, what I believe to be the most rudimentary Malayan language, as well as the most primitive Malayan tribe of the Philippines. I have recently had opportunity to examine ten brief vocabularies of the wild tribes of Formosa, which were printed in the Korea Review. Several of these vocabularies are very closely related to the Igorot. It can not be doubted, I think, that the migration which peopled Korea and the Batanes and Babuyan Islands was the same that gave to these northern mountains of the Philippines their present Igorot inhabitants. If I may go so far as to hazard a guess, it would be that these Malayan migrations went farther and reaching Japan formed the lower stratum of the present Japanese race.

The curious culture of these tribes, their primitive social organizations, their head-hunting feuds, their remarkable agriculture, and well-built populous towns will be described in detail in the monograph of Doctor Jenks, already cited as in preparation for the press. All told, these Igorot number no less than 180,000.

THE TINGIAN.

I have excluded from the Igorot the Tingian, although I believe them, with little doubt, to be Igorot. Their culture, which approximates that of the Ilokano, has led to their being separately considered. Changes in their manner of living have produced some changes in their outward appearance which, to the casual observer, seem to distinguish them. Their dialect (Itneg), however, is spoken by the Igorot joining them on the south in Tiagan and by other Igorot in the northern mountains of Bontok.

THE IBILAO.

From the Igorot I have also excluded the Ibilao or Ilongot. The physical type of these people, as well as their culture, seems to differ. It may be that a strain of Negrito blood has become so thoroughly disseminated among them as to be itself undiscernible, but nevertheless to have modified the physical type of the whole tribe of Ibilao. They use the bow and arrow and have a very decided taste for ornamental carving and engraving. They are very sparsely distributed through the Caraballo Sur and the rough mountain country between Nueva Vizcaya and Nueva Ecija and the Pacific Ocean. They are perhaps the most inveterate head-hunters of northern Luzon.

THE BUKIDNON.

I have adopted this term to describe the pagan population which is found scattered through the mountains and forests of some parts of Luzon, as well as in the interior of Panay and Negros. By the Spaniards these people were called Montescos, Remontados, etc., and a variety of local designations have distinguished them, such as Babylandes, Pulijanes, Mundos, Igorot, and Bukidnon or Bukitnon. It is this last term which I have adopted as being the most widely understood. It means people of the "bukid" or the "back country."

I believe the origin of these scattered people to be similar in every case. They are unconverted remnants of the Tagalog Bikol and Bisaya tribes, frequently crossed and mixed with the Negrito population, which they allied themselves with when they fled from the christianized towns. They speak what is frequently locally described as "pure Bisaya" and "pure Bikol," and everything about them points to their identity of origin with the Christian population.

THE MANGYAN.

These people are found to-day on the island of Mindoro, with a few representatives on the neighboring island of Sibuyan. In many cases the type is mixed with Negrito, who, though no longer reported as found in a pure type on Mindoro, appears as what must be half-breeds in the Mangyan communities. The pure Mangyan, however, is a typical, primitive Malayan; a slender, small man, with brown skin, dark, slightly wavy hair, and sensitive face and uneasy, distrustful disposition. To judge from the brief vocabulary which I collected among them his origin is not far removed from that of the christianized tribes of the Philippines. He seems to belong to a wild stock of low culture not reached by the early missionary efforts of the Spaniards, and closely allied to the tribe which follows, the Tagbanua.

THE TAGBANUA.

By this name are distinguished the primitive Malayan people who inhabit the islands of Busuanga and Palawan. On Busuanga the type seems to be pure Malayan, but on the island of Palawan there is evidence of considerable Negrito admixture, giving to many individuals frizzly mops of hair, an increased flatness and broadness of the nose, and the other characteristic signs of the crossing of the two races.

The original relationship between these Tagbanua and the Christian inhabitants of the Calamian group and Palawan has not been determined. Their dialects are said to differ, and the christianized population and they may be descended from seagoing Malayans, later arrivals than the Tagbanua.

The name is comprised of the Malay word *banua*, meaning "country," and the characteristic Philippine prefix *taga*, meaning "people of." The expression may be compared to *Orang-banua*, the name applied by the Malays to the ruder mountain tribes of the Malay peninsula.

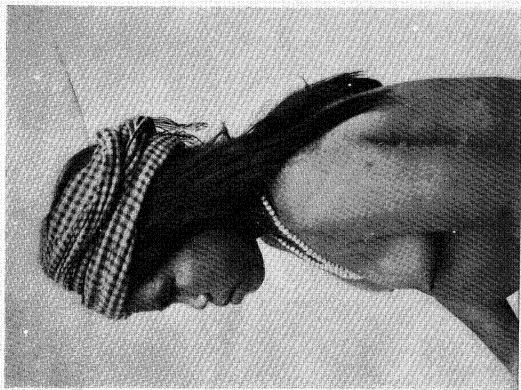
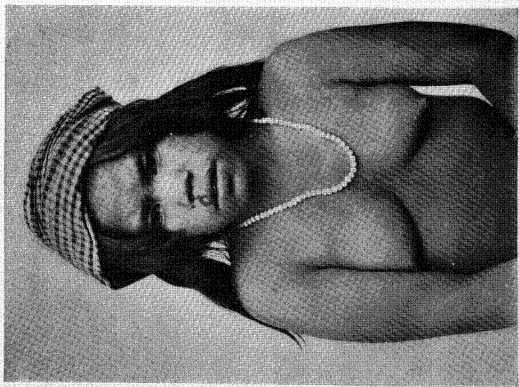
MONTESES AND MONOBO.

Northern Mindanao, apart from the Bisaya settlements along the coast, is inhabited by these two tribes, which, while separated by designation, appear to be closely allied. My opinion is also that they are very nearly related to the christianized Basaya.

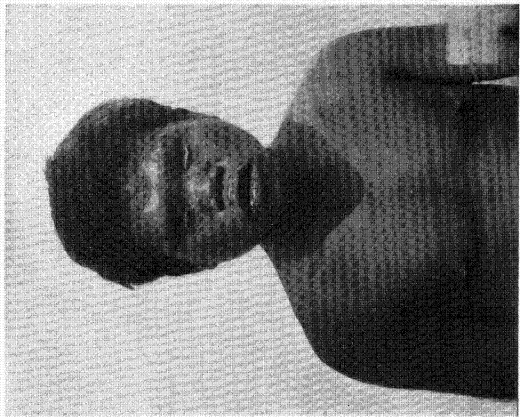
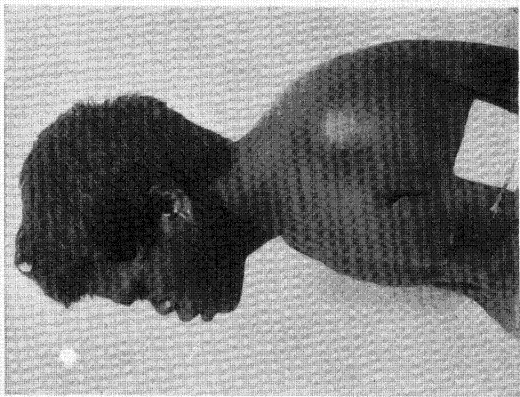
The industrial importance of these tribes has been considerable in the history of Mindanao. Practically all of the hemp which comes out of the ports of northern Mindanao is raised by the Pagans, and to their ancient working of mines is due the long-standing fame of Cagayan and Butuan for the production of gold.

THE SUBANON.

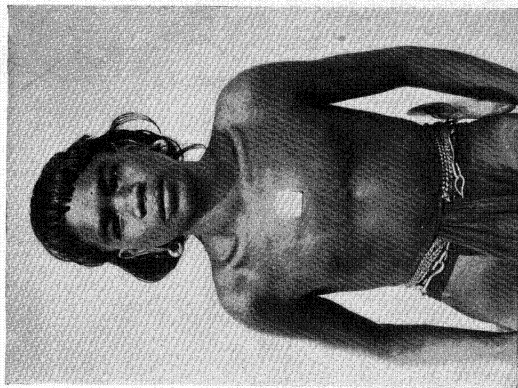
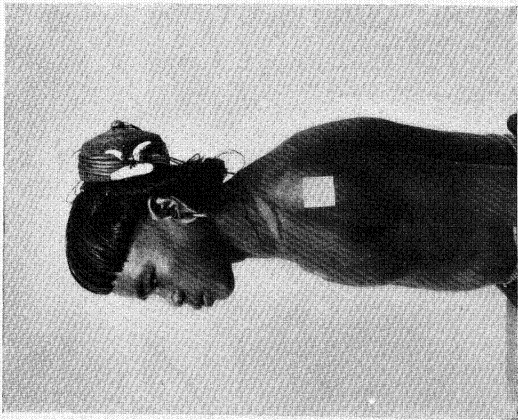
The only other tribe of western Mindanao is the Subanon, who can be reached from either the north or south coasts and who are found in small numbers in the upper part of the Zamboanga Peninsula, the "Panhandle." The tribe appears to belong to the typically Malayan race. There is no evidence among them of admixture. The type among men and women is very pure. They appear to be one of the oldest tribes to settle in Mindanao, and there is no present evidence that they were preceded here by the Negrito.



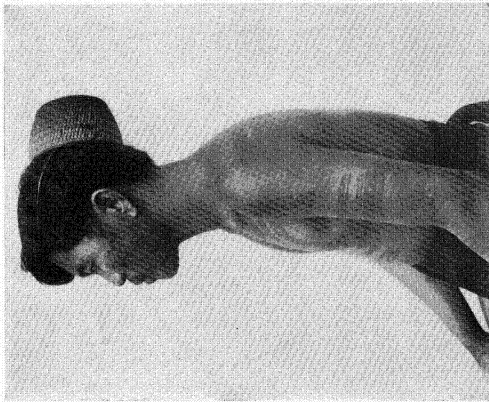
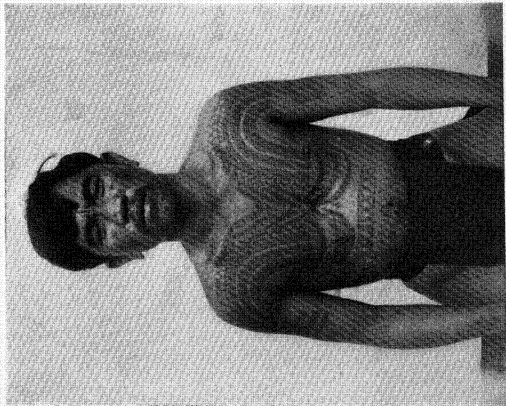
YOUNG IGORROTE WOMAN OF AMBUKLAO, BENGUET.



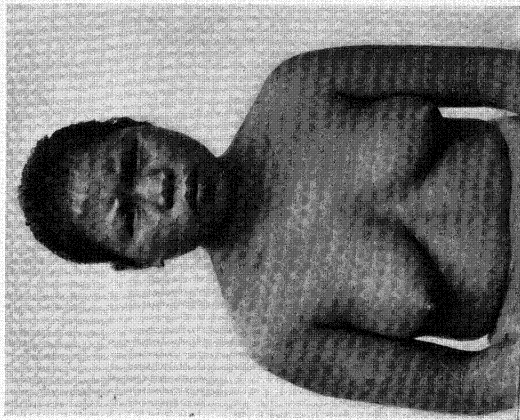
YOUNG IGORROTE MAN, MOUNTAINS OF KAYAPA.



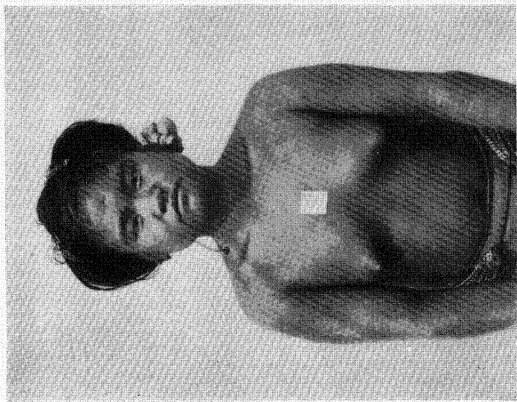
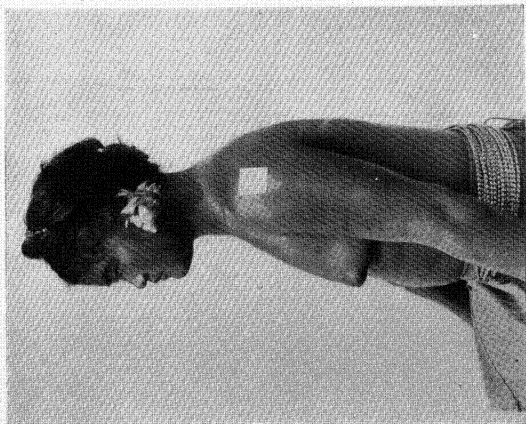
BONTOK IGORROTE.



BONTOK IGORROTE WITH ELABORATE TATTOOING OF THE HEAD HUNTER.



IGORROTE WOMAN OF BONTOK.



IGORROTE WOMAN OF BONTOK.

In spite of the primitive character of the Subanon many of their words betray a Sanscrit derivation, and their deities are known by the Malay Sanscrit name, *Diwata*.

Though not warlike and thoroughly cowed by the Moros, the Subanon religion demands a tribute of human life, and human sacrifice has more than once been offered in this tribe within the last year. Their name is compounded of the word *Suba*, "river," and the suffix *non*, and means "people of the river," as distinguished from the sea faring Malays.

PAGAN TRIBES OF EASTERN MINDANAO.

The great interior mass of this island lying east of Lake Lanao and south of the eighth parallel of latitude contains tribes known by a variety of names. At the north and scattered along the tributaries and headwaters of the Rio Grande de Mindanao are a few Monobo. In the mountains immediately south of this river are the Tiruray. Farther south, in the mountains facing the coast of the Celebes Sea, we again find hillsmen known as Monobo. Farther eastward are Bilan, while on the shores of the Gulf of Davao are Tagacaolo, Bagobo, Mandaya, and several other tribes whose exact character and affiliations remain to be determined. These are the tribes which have previously been referred to as "Indonesian." From what I have seen of them they appear to me to differ in no essential characteristic from the Subanon of western Mindanao. Many of the Mandaya on the east coast of Mindanao, from Caraga to Bailig, have been Christianized within the last half century by Jesuit missionaries and are almost indistinguishable from the Bisaya, who inhabit the same towns. The wild, forest-dwelling Ate, north of Mount Apo, appear to be mixed Malayan and Negrito.

These various tribes of Mindanao, while pagans and characterized by customs of human sacrifice, head hunting, and perhaps ceremonial cannibalism, are by no means mere savages in culture. They are the only productive laborers in Mindanao, planting rice, maize, taro, hemp, etc. Their women weave and dye beautiful garments and blankets of hemp fiber, and clothing is more ornate and beautiful among some of these tribes than anywhere else in the Archipelago. Their weakness as compared with the Moros consists in the fact that the latter have possessed a decided advantage over them in weapons and organization.

The above enumeration, brief as it is, includes all of the pagan tribes of these islands. With the exception of the Igorot they are very weak in numbers, and are nowhere to be found living in large or compact communities. On the contrary, they are usually scattered through the foothills, a few here and there, living in temporary clearings and shifting their abodes as fresh openings are made in the forest for planting their humble products. Their great weakness consists in their rudimentary and inadequate political capacity. Only under the influence and with the succor of the Mohammedan faith has the native inhabitant of the Philippines even attained any considerable organization of his numbers into a common political society. As a rule his interests and sympathies do not pass beyond the limits of his kindred or small community. In this respect the Malayan is strikingly inferior to the American Indian, who everywhere attained the tribal organization, and who, furthermore, built up such great and permanent states as the Iroquois and Nahuatl confederacies.

THE MOHAMMEDAN TRIBES OF SOUTHERN MINDANAO AND THE SULU ARCHIPELAGO.

The Mohammedan tribes of the Philippines were collectively designated by the Spaniards as "Moros" or "Moors." This is not a tribal name nor an ethnic designation at all. The Moros or Mohammedans of the Philippines comprise a number of separate and distinct tribes of different origin and character. The main elements seem to have been an aboriginal population closely akin to the Subanon or other pagan tribes of Mindanao with a true Malay strain, brought in by those ceaseless voyagers and emigrants, the Samal Laut.

Mohammedanism entered Malaysia probably as early as the twelfth century. The chronicles of the Mohammedan princes of Malacca ascribe their conversion to a later date than this, but Marco Polo, who spent many months on the east coast of Sumatra in 1268, states emphatically that the inhabitants of the coast were even at that date "Saracens." The Mohammedan trader is always a proselyter as well, and the eastward extension of Islam followed immediately when the rich trade of the Mediterranean with India and the Far East fell into Arab hands. The conversion to Mohammedanism of the seafaring peoples of the Straits of Malacca and the coasts of Sumatra and Johore was the beginning of the historical prominence of the Malay. Their voyages for trade and conquest began to extend until a few centuries later even the distant Celebes and Moluccas were united with western Malaysia by the possession of a common faith and a common language of trade. Probably early in the fourteenth century the Malays established on the west coast of Borneo the settlement or sultanate of Brunei or Burnay (whence Borneo), and it was from this center that Mohammedanism spread to the Philippines.

When the Spaniards first reached the islands, from 1521 to 1565, Malay proas from Borneo cruised and traded throughout the Bisaya Islands, and there were flourishing Moro settlements and strongholds on Mindoro, Lubang, and the shores of Manila Bay. Manila, as well as Tondo, was a Mohammedan town ruled over by a Moro dato. Jolo and the coast of Maguindanao appear to have been Mohammedanized at least a century before the Spaniards' arrival. The written histories and genealogies of the Maguindanao, Samal, and Sulu Moros all trace their conversion to princes coming from Borneo or Johore.

THE SULU.

The most prominent of the Moro tribes are and always have been the Sulu, pronounced also *Sulug* and *Swug*. The center of their tribe and the seat of the sultanate is the island of Jolo, but they are found in an authoritative position throughout the Sulu Archipelago, and in almost every case the Samal populations are ruled over by datos of Sulu birth or connection. The Sulus are a mixed race, the most so, I believe, of the Moro tribes. We find among their population several types differing in physical peculiarities, which are sometimes puzzling, and which could only have occurred through mixture with other distant tribes of Malaysia. They have played a conspicuous part in the past history of this Archipelago, but in late years their relative importance and power have declined. Their numbers in the jurisdiction of the United States are considerably fewer than in the past. Many of them have migrated to the north coast of Borneo, and are living under the rule of the British North Borneo Company.



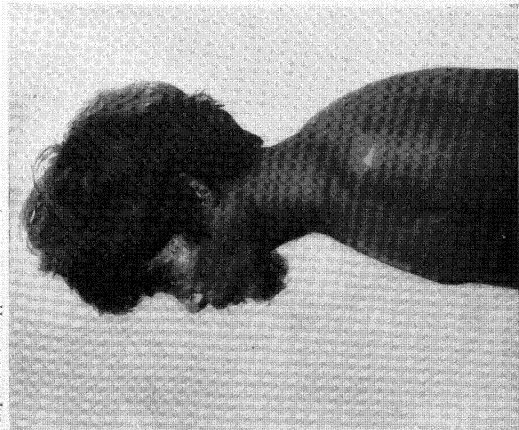
IBILAO MAN, NUEVA VIZCAYA.



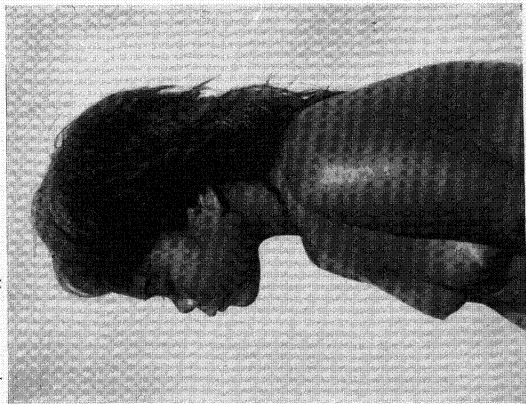
SUBANON, "TIMUAY," DUMANQUILAS BAY MINDANAO.



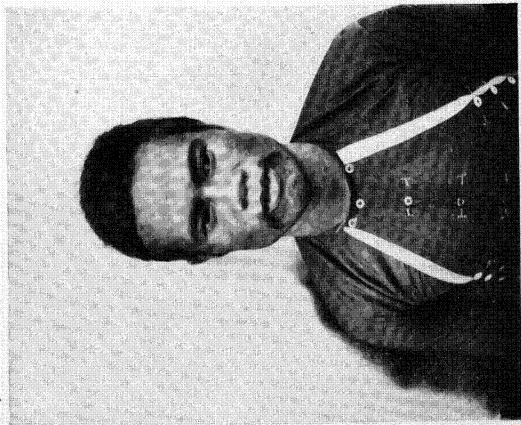
IBILAO HUNTER IN RAIN COAT AND HAT OF DEER HIDE, MOUNTAINS OF EASTERN
NUEVA VIZCAYA.



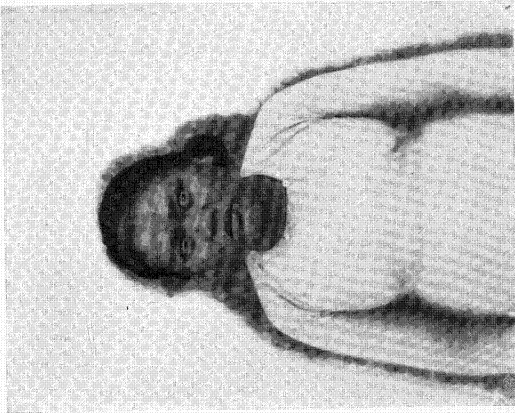
MANGYAN MAN FROM FORESTS OF MINDORO.



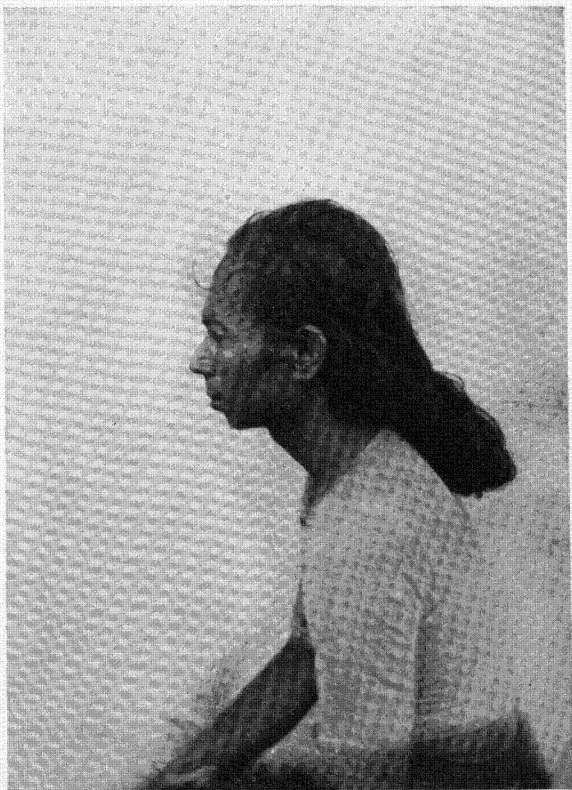
MANGYAN WOMAN FROM FORESTS OF MINDORO.



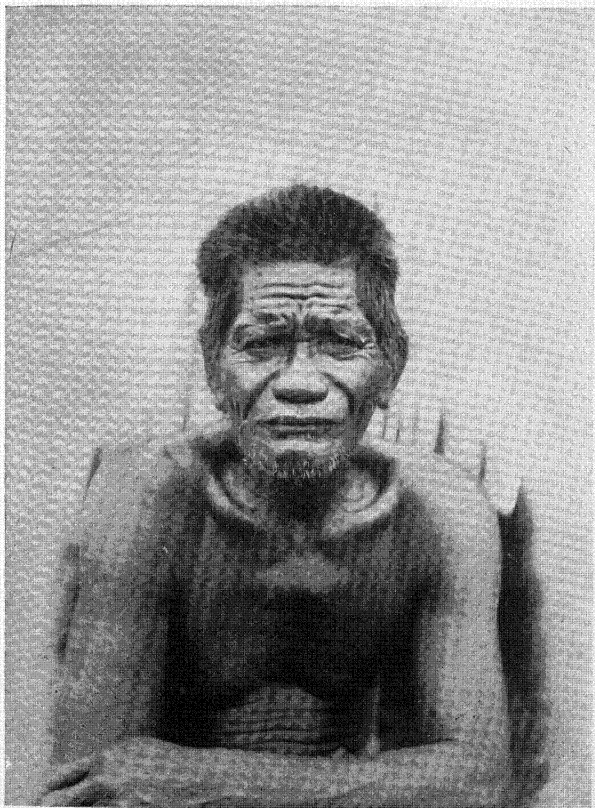
SUBANON MAN, DUMANQUILAS BAY, MINDANAO.



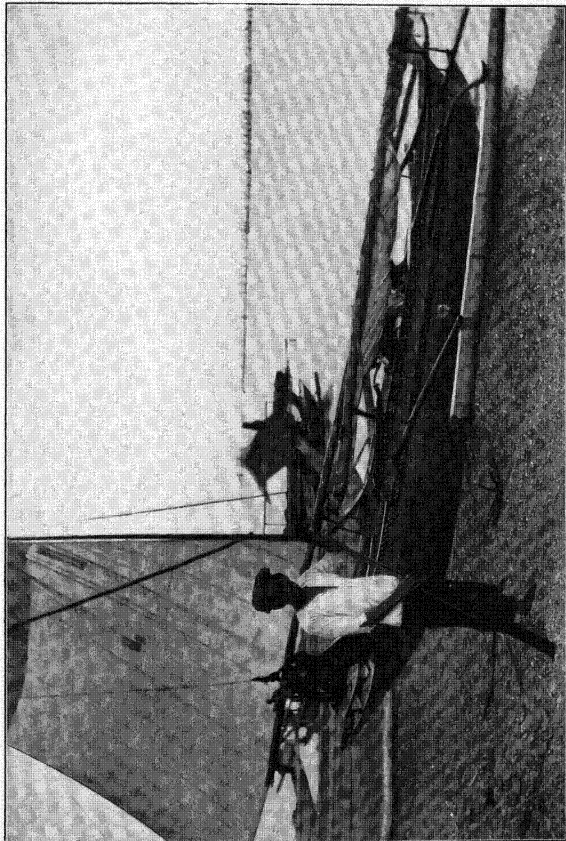
SUBANON WOMAN, DUMANQUILAS BAY, MINDANAO.



YAKAN MORO OF THE ZAMBOANGA PENINSULA.



SULU MORO MAN, COARSE TYPE.



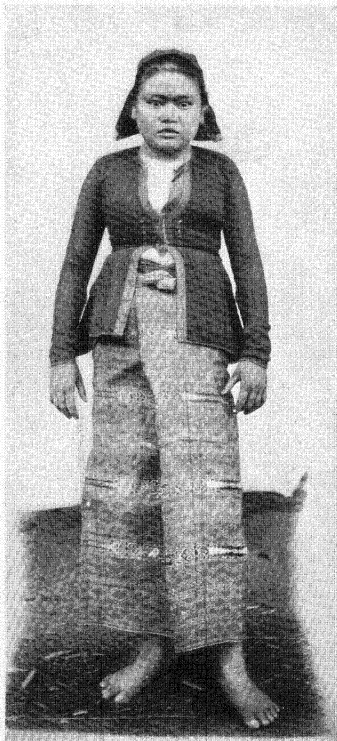
VINTA OR MORO SAILING BOAT, WITH SAMAL MAN.



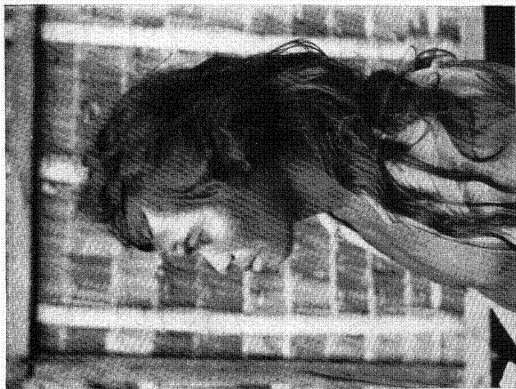
IGORROTE WOMAN, MOUNTAINS OF KAYAPA.



IBILAO MAN, NUEVA VIZCAYA.



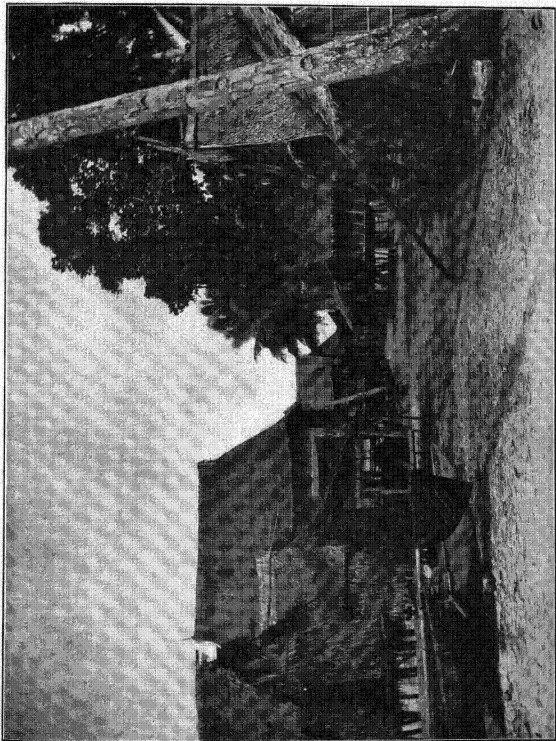
SUBANON WOMAN, SHOWING NATIVE SKIRT OR "TAPIS,"
WOVEN OF HEMP.



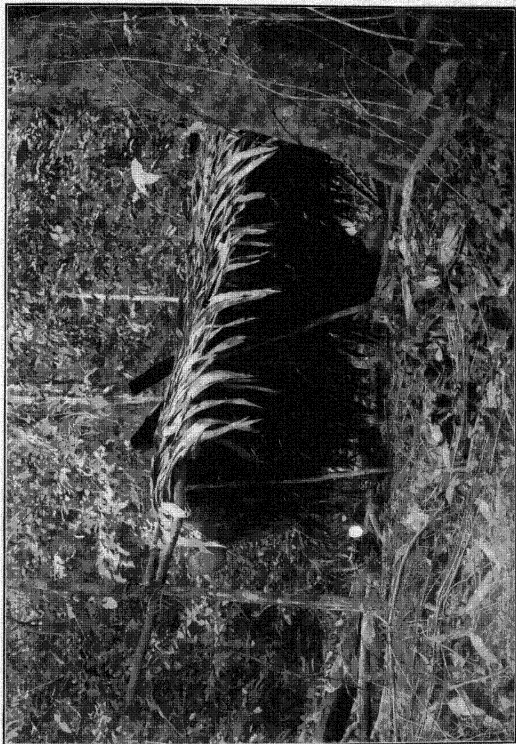
YAKAN MOROS, ISLAND OF BASILAN.



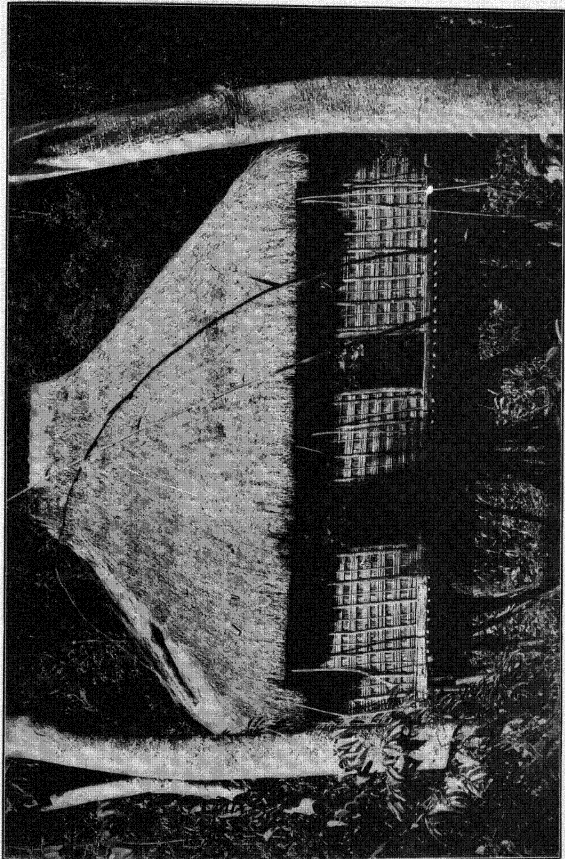
PHYSICIAN UNDER BOARD OF HEALTH INOCULATING CHINESE IN SHOP WHERE A CASE OF PLAGUE OCCURRED.



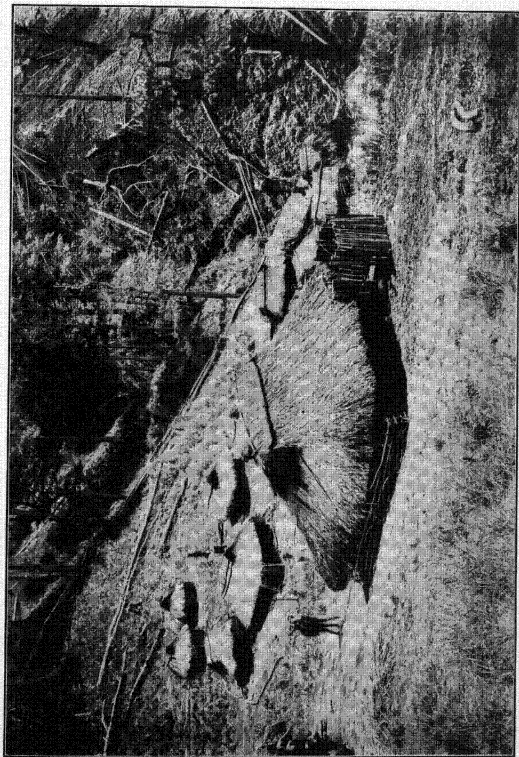
SAMAL MORO VILLAGE, MINDANAO.



MANGYAN HUT IN FOREST OF MINDORO.



IBILAO HOUSE IN THE FOREST EAST OF DUPAX, NUEVA VIZCAYA.



IGORROTE VILLAGE IN THE MOUNTAINS OF KAYAPA.

THE SAMAL.

This widely scattered tribe is, in my opinion, the true Malay, the Orang Salat of the Straits. They are wholly a seafaring people, never found away from the coasts, and always living either in their boats or in buildings over the sea, on low reefs and small coral islands. They are, in fact, simply descendants of the notorious "sea gypsies," but in this Archipelago they have so far separated from their constant life in boats as to build settlements and permanent villages on the shore. Their subordinate political position, as well as their insecure tenure upon land, indicate that they came into the Sulu Archipelago after the conversion of these islands to Mohammedanism and the organization of the sultanates of Sulu and Maguindanao.

They have, however, scattered widely over all this region and are to be found on almost all inhabited islands and coasts of this part of the Philippines from Tawi Tawi to Davao. Indeed, the first seafaring Malay encountered by the Spanish discoverers among the islands north of Surigao seem to have been these same people, and I am inclined to think that the name of the island of Samar is derived from this tribe. The name Samal or Sama means in their own language simply "companion."

Fifty years ago the Samal had important settlements on the group of islands between Jolo and Basilan. Here, on the islands of Tonquil and Balinguingui, were the very last strongholds of piracy to be destroyed by the Spaniards. When the Spaniards, with the aid of gunboats, finally leveled the fortifications and villages of the Samal on these islands, they scattered the inhabitants and exiled one party to Cagayan de Luzon. The descendants of these people were still living on a tobacco hacienda of Isabela when these islands were ceded by Spain, and were returned to Zamboanga two years ago by direction of the Philippine Commission. Since their crushing defeat by the Spaniards the Samal have engaged very little in piracy.

THE SAMAL LAUT OR BAJAU.

This is the rude seafaring tribe from whom the Samal people are derived. They live wholly in their small boats or *vintas*, never building homes upon the shore. Their little vessels, in fleets of six to ten, are to be met with in every part of the Sulu Archipelago and along the southern coast of Mindanao. They are a rude and undeveloped race, depending almost wholly upon the sea for their sustenance. They are very imperfectly Mohammedanized and are regarded with contempt by the Sulu and more advanced Samal, who refer to them as pagans and swine eaters. They have the most rudimentary social organization and submit temporarily to the government and exactions of the *dato* on whose coast their boats are, for the time being, finding shelter. In small quantities they gather the sea products of these waters; pearl shell, trepang or *bêche de mer*, shark fins, the edible seaweed, etc. In some cases they display a readiness to settle down and recruit the numbers of their affiliates, the Samal. They have always borne a very bad reputation, and centuries ago were described by the Portuguese historian, De Barros, as "a people who dwell on the sea and whose occupation is to rob and to fish."

THE YAKAN.

These are a distinct people of the primitive Malayan type, the inhabitants of the island of Basilan. They seem to be closely related in type and in culture to the Subanon of the Mindanao mainland. They were proselyted to Mohammedanism some generations ago, and are fierce and fanatical Moros. They are about 25,000 strong on Basilan, and obey only the old Tagalog renegade, Dato Kalun, or Pedro Cuevas. From Basilan the Yakan in recent years have migrated to some of the small islands scattered along the coast of the Zamboanga Peninsula, and have also formed settlements on the mainland.

THE KALIBUGAN.

These sparse people appear to be neither more nor less than Subanon who have been converted to Mohammedanism and have joined the settlements of Samal or Yakan. The slow process to conversion of the pagan tribes of Mindanao to Islam still proceeds and may eventually make all of these hill men followers of Mohammed. Islam is still one of the great missionary religions.

THE ILANON.

These are the Moro tribes occupying the coast of Illana Bay from Pagadian Bay to Pollok, and their name, which means "people of the lake," would indicate that they are closely related to the Lanao Moro of the interior of Mindanao. The Ilanon are now very few in number, and present small evidence of their former power, yet these were perhaps the worst pirates of Mindanao. Some of the tribe appear to have settled on the island of Borneo, where they are reported to be.

THE MALANAO.

These are the fierce and unsubdued Moros of the Lake Lanao region, who have been repeatedly whipped during the last year and a half by the expeditionary forces of the United States Army. They were never conquered by the Spaniards, and in spite of the severe punishment they have recently received they seem hardly ready to yield and accept the situation.

THE MAGINDANAO.

This is one of the most advanced and, after the Sulu, the most important of the Moro tribes. Their habitat has always been the fertile valley of the Rio Grande de Mindanao, but they also range south along the coast, and there are several thousand in Sarangani Bay. Several generations ago they also made colonies in Sibuguey and Dumanquilas bays, where they are still found, though in apparently reduced numbers. The datos of the royal line in this last region received from the Spaniards the rank and title of "Princes of Sibuguey." This branch is represented at the present time by Dato Dakula, of Cumalarang.

Formerly the Magindanao divided with the Sulu the sovereignty all this Moro territory. The Sultanate of Sulu comprised the Sulu Archipelago, the north shore of Borneo and southern Paragua, while the Sultan of Magindanao was the overlord of all Moro tribes on the mainland of this great island. Both of these powers are now singularly decayed.

The Sultanate of Magindanao is in fact no longer a factor of any consequence in the situation. The present sovereign, Sultan Mangigin, who was elected to his position about thirteen years ago by a council of Magindanao *datos*, is now an exile from Cotabato, very poor, without fixed residence, a victim of the opium habit, and without present prestige or power to regain his position. I met him at Dinas a few months ago. He was anxious to be returned to Cotabato, and to have the Americans follow the Spanish custom of dealing with all Moros through him, but there could be no greater political mistake made than to restore this ruler and reorganize his authority as overlord of this island. The decayed position of the state of Magindanao is the condition toward which the Sultanate of Sulu is also tending. This latter power, whose importance has been greatly exaggerated, is also at the present time represented by a weak and unpopular man, whose only support is a small clique of councillors at variance with each other and ineffectively intriguing against each other and against the other Moro *datos*, many of whom are more powerful than the Sultan himself.

The Bates agreement should not stand in the way of the Philippine government in taking over the administration of the Sulu Archipelago.

GENERAL RESULTS OF THE YEAR'S WORK.

As stated above, the preliminary survey of the whole group of islands has been well advanced by this year's work in the field. We are ready to make report upon the two most important bodies of non-Christian peoples—the Igorot, of northern Luzon, and the Moros, of the south. Other tribes have been sufficiently studied to enable us in most cases to assert their general character and condition.

The following regions, however, have been either imperfectly explored so far or entirely await investigation: In northern Luzon, the extremity of the Cordillera, sparsely settled by the Apoyao Igorot, as well as the lower lands between the mountain chain and the Cagayan River, constitute an area on which we have most unsatisfactory data and which has not attracted American exploration.

In the last years of Spanish sovereignty that Government established here the two commandancias of Apoyaos and Cabugaoan. Brief relations by the commanding officers of these two districts are found in the Philippine archives, but nothing is known about their present condition. A map of this end of the Cordillera also exists, which shows at least two Igorot trails leading across the mountains into Ilocos Norte, but I doubt if they were ever crossed by Spaniards.

To the east of the Rio Cagayan is another actual *terra incognita*, the mountains of the northern chain of the Sierra Madre, embracing the valley of the reputed Lake Cagayan. This region is inhabited by Negritos who are feared by the dwellers on the Cagayan River, and described as cannibals and drinkers of human blood. The real difficulty, however, in the way of exploration is probably not the dangerous character of the few savages who roam these rugged hills, but the impenetrable character of the mountain forest and the difficulty of transporting sufficient food to cross the range.

The island of Palawan, while comparatively well known, demands further attention from the workers of this bureau before decision can be made as to the character and derivation of its pagan inhabitants.

Similarly, Mindoro invites further exploration, although the type generally of the Manguian can be described from observations already made.

There remains the gulf region of Davao, which, although pretty well known along beaten trails, is a field for much debate on the true character of its inhabitants. My personal views on these tribes are hazarded in this report, but the problems, which are most interesting ones, can only be settled by thorough study and months of life and travel among these regions facing the Gulf of Davao and lying north of Mount Apo into the interior of Mindanao.

The general result of the year's work, taken in connection with the returns of the Philippine census, has been to greatly reduce the estimated number of the non-Christian inhabitants of the islands. Spanish estimates, upon which we necessarily relied, placed the total number at from 1,500,000 to 2,000,000 souls. The Philippine census has made the first and only careful series of enumerations and estimates ever attempted, and its results place the pagan inhabitants at no more than 400,000, and the Mohammedan at about 253,000. It would be improper to anticipate the results of the census of the non-Christian tribes, which will be published by the census bureau, but the following facts have been already given out for publication and can be restated here.

The largest element of error in the previous estimates lay in the exaggerated notions held by the Spaniards as to the power of various Moro tribes. These have been strikingly reduced by the census and are worthy of great consideration in facing the problems offered by the hostility or enmity of some of these tribes. Other regions where population had been previously exaggerated are the district of Davao, the interior of Mindoro, and the northern provinces of Mindanao. On the other hand, the rugged mountains of Bontok contain a population almost as dense as can be found in the mountains of any part of the world. It actually exceeds in density that of the Swiss mountain canton Uri.

A second result of the year's investigation has been to reduce in a marked degree the reputed number of tribes. Previous lists have contained the names of what were supposed to be as many as 80 distinct peoples. But in the most respectable and authoritative of these enumerations there are several names set down which are unknown as tribal designations in the regions where these tribes are supposed to be located. Frequently the same people are enumerated or described several times under different designations, for example: "Ibilao" and "Ilongot" are terms employed by different Christianized towns in speaking of exactly the same tribe. I have sought, in framing a nomenclature for these tribes, to reduce the number of designations and to group together communities so closely related as to be unquestionably of the same origin. As an example of this reduction, I believe that all the tribes of the Cordillera Central belong to one common stock; and as they themselves know of no such political organization as a tribe, and can be classified only geographically or according to the slightly modified dialects which they speak, I believe it scientific to apply to all of them the term which has found common acceptance in foreign and Spanish literature for more than three hundred years, "Igorot." A similar rejection of names may be made in the Gulf of Davao region, and altogether I find that perhaps no more than 16 tribal

names are necessary to designate all the pagan tribes of the islands, while 8 names correctly designate the Mohammedan tribes or Moros.

The general ethnological problem, too, appears to be less confused than appeared a year ago. The differences which separate many tribes are not so much those of race as of cultivation. The theory of a series of diverse immigrations into these islands can be rejected. There may have been a break between the movements of population that placed the Igorot in the center of the Cordillera and the Mangyan in the interior of Mindoro, but most of the Philippines arose, I believe, from a migration from the south that was homogeneous and continuous rather than varied and interrupted. I am also disposed to reject the theory that fundamental differences separate the tribes of Davao from the Malayan races of the Archipelago. They appear to be the same race. I doubt if the term "Indonesian" is a proper one to apply to them. What we appear to have in these rude races of the Philippines is the pure, brown Malayan race, sufficiently distinct from the other races of the globe to be entitled to separate recognition—just as distinct, at least, as is the American Indian. The race was doubtless anciently derived from the Asian continent, but has been so modified in type, language, and culture by life in the islands of the tropic seas that it is a race by itself. While recent theories have regarded the Malay as not a pure race, but a mixture of Mongolic and Caucasian strains, Blumenbach's famous old classification of mankind into five main branches, the white or Caucasian, the yellow or Mongolian, the black or Negro, and the brown or Malay, is worthy of revived consideration. His color distinctions may fail, but I believe the distinct place he assigned to the Malayan race will stand. The people of the Philippines, with the exception of the Negrito, in my opinion, all belong to this tropical island race. We have tribes representing the whole scale of culture from savagery to civilization, but barring the frequent crossings with the Negrito, Mongolian, and European, all of a single race and common origin.

Specific report or recommendation upon legislation for the pagan and Mohammedan tribes will not be included here, but I may add, in conclusion, that the practical problems of administration are less difficult than they appeared a year ago. The ferocity of these tribes, while hardly exaggerated by the Spaniards, breaks down more quickly than could have been expected in the presence of the American Government. Head-hunting in the north and slavery and raiding in the south can be stopped just as soon as a proper effort is made.

Very respectfully,

DAVID P. BARROWS,
Chief of Survey.

The honorable the SECRETARY OF THE INTERIOR.

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